HLFR\_PIC

|  |  |
| --- | --- |
| Author: | Hunt, Ryan (rhunt80) |
| Reviewer(s): |  |
| Date Issued: |  |
| VSEM ID & Revision: | 200530– C |
| Snapshot Name: |  |
| VSEM Release Status: |  |

**Table of Contents**

[HLFR\_PIC(200530; C) 10](#_Toc80729308)

[1. Plug-In Charging High Level Function (PIC) (200546; A) 10](#_Toc80729309)

[2. Document Summary (200547; A) 10](#_Toc80729310)

[3. PIC High Level Design (200542; A) 10](#_Toc80729311)

[3.1. Description / Scope (200537; A) 10](#_Toc80729312)

[3.2. PIC P-Diagram (200539; A) 12](#_Toc80729313)

[3.2.1. PIC Scope (200531; A) 12](#_Toc80729314)

[3.2.2. PIC Inputs (200532; A) 12](#_Toc80729315)

[3.2.3. PIC Outputs (200533; A) 12](#_Toc80729316)

[3.2.4. PIC Control Factors (200534; A) 13](#_Toc80729317)

[3.2.5. PIC Noise Factors (200535; A) 13](#_Toc80729318)

[3.2.6. PIC Error States (200536; A) 13](#_Toc80729319)

[4. PIC Ideal Functions (200543; A) 13](#_Toc80729320)

[4.1. IF-REQ-271030/A-Driveaway While On Charge 13](#_Toc80729321)

[4.2. IF-REQ-271031/A-State of Charge 13](#_Toc80729322)

[4.3. IF-REQ-271032/A-Vehicle Charging 14](#_Toc80729323)

[4.4. IF-REQ-271033/A-Low Voltage Support 14](#_Toc80729324)

[4.5. IF-REQ-271034/A-Plug Status 15](#_Toc80729325)

[4.6. IF-REQ-271036/A-Hold-Off After Charge Complete 15](#_Toc80729326)

[4.7. IF-REQ-271037/B-Cord Unlock 16](#_Toc80729327)

[4.8. IF-REQ-271038/A-DC Fast Charge 16](#_Toc80729328)

[5. PIC System/Derived Requirements (PIC SRs) (200544; A) 17](#_Toc80729329)

[5.1. SR-REQ-137807/D-Drive Away While on Charge 17](#_Toc80729330)

[5.1.1. DR-REQ-140520/B-Torque Not Available While on Plug 18](#_Toc80729331)

[5.1.1.1. DR-REQ-326489/A-VMP Shutdown for preventing wheel torque on MHT 19](#_Toc80729332)

[5.1.2. DR-REQ-140521/B-Prevention of Gear Shifting on Plug 21](#_Toc80729333)

[5.1.2.1. DR-REQ-344076/A-FMEM - Arbitrated Plug Status Missing Message for BCM 22](#_Toc80729334)

[5.1.3. DR-REQ-378360/A-Shift to Park while On Plug 22](#_Toc80729335)

[5.1.4. DR-REQ-140522/A-Cluster Indication - Charging Mode 23](#_Toc80729336)

[5.1.5. DR-REQ-234396/A-Cluster Indication - On Plug Tell-tale 24](#_Toc80729337)

[5.1.6. DR-REQ-140523/A-Cluster Indication - Unplug Vehicle 25](#_Toc80729338)

[5.1.7. DR-REQ-140525/A-Inductive Charging Drive Away 25](#_Toc80729339)

[5.1.8. DR-REQ-140557/C-Plug Status Override 26](#_Toc80729340)

[5.1.8.1. DR-REQ-140562/B-Is the Vehicle Plugged In Command 29](#_Toc80729341)

[5.1.8.2. DR-REQ-140559/A-Cluster Message - Plug Override 30](#_Toc80729342)

[5.1.8.3. DR-REQ-413897/A-Plug Override Recovery 31](#_Toc80729343)

[5.1.9. DR-REQ-328645/A-DTC - Driving on plug 31](#_Toc80729344)

[5.1.10. Referenced Requirements (470634; B) 32](#_Toc80729345)

[5.2. SR-REQ-137812/A-State of Charge Definition 32](#_Toc80729346)

[5.2.1. DR-REQ-207319/A-Battery State of Charge Signal 32](#_Toc80729347)

[5.2.2. DR-REQ-207320/B-Customer State Of Charge Signal 33](#_Toc80729348)

[5.2.2.1. DR-REQ-328367/A-CSoC at Charge Complete 34](#_Toc80729349)

[5.3. SR-REQ-137806/C-Conditions for Charging 35](#_Toc80729350)

[5.3.1. DR-REQ-140444/A-Start Charging Requirements 36](#_Toc80729351)

[5.3.1.1. DR-REQ-242070/B-BECM Charge Wait 37](#_Toc80729352)

[5.3.1.2. DR-REQ-214924/B-BCCM Charge Ready 38](#_Toc80729353)

[5.3.1.3. DR-REQ-214922/B-BECM Charge Ready 39](#_Toc80729354)

[5.3.1.4. DR-REQ-235773/A-BECM Charging 40](#_Toc80729355)

[5.3.1.5. Charging FMEM Actions (470789; C) 40](#_Toc80729356)

[1.1.1.1.1 DR-REQ-271256/A-FMEM - BECM Fault 40](#_Toc80729357)

[1.1.1.1.2 DR-REQ-271257/A-FMEM - BCCM Fault 41](#_Toc80729358)

[1.1.1.1.3 DR-REQ-271258/A-FMEM - Torque Status Signal 41](#_Toc80729359)

[1.1.1.1.4 DR-REQ-271259/B-FMEM - Gear Position Signal 42](#_Toc80729360)

[1.1.1.1.5 DR-REQ-271260/A-FMEM - Charge Inhibit Signal 43](#_Toc80729361)

[1.1.1.1.6 DR-REQ-271261/A-FMEM - Charger Ready Status 44](#_Toc80729362)

[1.1.1.1.7 DR-REQ-271262/A-FMEM - Battery Charge Ready Status 45](#_Toc80729363)

[1.1.1.1.8 DR-REQ-344077/A-FMEM - EVSE Status Signal 46](#_Toc80729364)

[1.1.1.1.9 DR-REQ-346401/A-FMEM - On Board Fault 46](#_Toc80729365)

[1.1.1.1.10 DR-REQ-347824/A-FMEM - BECM Timeout 47](#_Toc80729366)

[1.1.1.1.11 DR-REQ-355178/A-FMEM - Charge Target Signal 47](#_Toc80729367)

[5.3.2. DR-REQ-140445/B-Continue Charging 48](#_Toc80729368)

[5.3.3. DR-REQ-140446/B-End Plug-in Charging 49](#_Toc80729369)

[5.3.3.1. DR-REQ-358756/A-BECM Charge Complete Declaration 50](#_Toc80729370)

[5.3.4. DR-REQ-140526/A-End Inductive Charging 51](#_Toc80729371)

[5.3.5. DR-REQ-140541/A-BCCM Contactor Power Assertion 51](#_Toc80729372)

[5.3.6. DR-REQ-140542/C-BCCM Contactor Power De-Assertion 52](#_Toc80729373)

[5.3.7. DR-REQ-140543/A-BCCM Contactor Power Diagnostics 54](#_Toc80729374)

[5.3.8. DR-REQ-140546/B-Contactor Power- Invalid Contactor Command from BECM 54](#_Toc80729375)

[5.3.9. DR-REQ-221352/A-Conductive Charging Preferred 55](#_Toc80729376)

[5.3.10. DR-REQ-193867/D-BECM Event Wakeups 55](#_Toc80729377)

[5.3.10.1. DR-REQ-261943/B-Charge Target Reached Event Wakeup 56](#_Toc80729378)

[5.3.10.2. DR-REQ-262123/D-Charge Requested CAN Sustain 57](#_Toc80729379)

[5.3.10.3. DR-REQ-314690/C-DC Charge Requested CAN Sustain 59](#_Toc80729380)

[5.3.11. DR-REQ-358740/B-Disable Charging for OTA flashing 60](#_Toc80729381)

[5.4. SR-REQ-137814/A-12V Battery Support On Plug 61](#_Toc80729382)

[5.4.1. DR-REQ-213756/B-LV Energy Transfer on Charge 62](#_Toc80729383)

[5.5. SR-REQ-137813/C-Detection of Plug Events 62](#_Toc80729384)

[5.5.1. DR-REQ-235507/B-Raw Plug Status Signal 63](#_Toc80729385)

[5.5.1.1. DR-REQ-140555/A-Plug Status Fault Detection 64](#_Toc80729386)

[5.5.2. DR-REQ-137808/C-Types of Charging 66](#_Toc80729387)

[5.5.2.1. DR-REQ-271039/A-EVSE Not Compatible 68](#_Toc80729388)

[5.5.2.2. DR-REQ-271040/A-EVSE Faulty 68](#_Toc80729389)

[5.5.3. DR-REQ-193866/C-BCCM Event Wakeups 69](#_Toc80729390)

[5.5.3.1. DR-REQ-261818/A-Plug Status Event Wakeup 70](#_Toc80729391)

[5.5.3.2. DR-REQ-261819/D-Charging Status Change Wake Event 70](#_Toc80729392)

[5.5.3.3. DR-REQ-261820/B-Charger Power Available Change Wake Event 71](#_Toc80729393)

[5.5.4. DR-REQ-309265/A-External Charge Fault Display 72](#_Toc80729394)

[5.5.4.1. DR-REQ-271049/B-EVSE Faulty - Cluster Notification 74](#_Toc80729395)

[5.5.5. DR-REQ-271048/B-EVSE Not Compatible - Cluster Notification 74](#_Toc80729396)

[5.5.6. DR-REQ-361978/A-Multiple Charge Ports - DC Priority 75](#_Toc80729397)

[5.5.6.1. DR-REQ-382186/A-Multiple Charge Ports - Cord Unlock Request 76](#_Toc80729398)

[5.6. SR-REQ-137810/A-Hold-Off Charging after Charge Complete 77](#_Toc80729399)

[5.6.1. DR-REQ-238478/A-Hold-Off after Charge Complete 77](#_Toc80729400)

[5.6.2. Charge Target FMEM Actions (470790; A) 79](#_Toc80729401)

[5.6.2.1. DR-REQ-271263/A-FMEM - Charge Target Signal 79](#_Toc80729402)

[5.7. SR-REQ-193480/B-Cord Lock/Unlock Requirements 80](#_Toc80729403)

[5.7.1. DC Cord Unlock Requirements (470661; B) 81](#_Toc80729404)

[5.7.1.1. DR-REQ-193486/B-DC Fast Charge - Unlocking EVSE 81](#_Toc80729405)

[1.1.1.1.12 DR-REQ-193490/B-DC Fast Charge - Unlock Request 82](#_Toc80729406)

[5.7.1.2. DR-REQ-193488/A-DC Fast Charge - Cord Lock During Power Transfer 83](#_Toc80729407)

[5.7.1.3. DR-REQ-369554/A-DC Cord Lock - BECM Available 83](#_Toc80729408)

[5.7.2. AC Cord Unlock Requirements (470662; B) 84](#_Toc80729409)

[5.7.2.1. DR-REQ-258010/B-AC Charging Unlock Requirements 84](#_Toc80729410)

[1.1.1.1.13 DR-REQ-193483/C-Conductive Charging - Cord Unlock Request 85](#_Toc80729411)

[1.1.1.1.14 DR-REQ-193495/C-Conductive Charging - Unlocking Cord Set 86](#_Toc80729412)

[1.1.1.1.14.1 DR-REQ-316891/A-Unlocking FMEM - AC Voltage 89](#_Toc80729413)

[1.1.1.1.15 DR-REQ-193484/A-CAN Request for Secure Cord Unlock - BCM 89](#_Toc80729414)

[1.1.1.1.16 DR-REQ-271247/B-AC Cord Lock - APIM Enable 91](#_Toc80729415)

[5.7.2.2. DR-REQ-295883/A-AC Cord Lock - BCM Available 92](#_Toc80729416)

[5.7.3. Shared Cord Unlock Requirements (470663; B) 92](#_Toc80729417)

[5.7.3.1. DR-REQ-271059/B-Cord Re-lock strategy for EU 92](#_Toc80729418)

[~~1.1.1.1.17~~ ~~DR-REQ-369553/A-HEV Wake for cord re-lock~~ 93](#_Toc80729419)

[5.7.3.2. DR-REQ-193482/A-Unlocking Cord Set Button - Inlet Port Housing 93](#_Toc80729420)

[5.7.3.3. DR-REQ-193485/A-Inlet Port Antenna Search Area 94](#_Toc80729421)

[5.7.3.4. DR-REQ-194504/A-Detection of EVSE Unlock Button 95](#_Toc80729422)

[5.7.3.5. DR-REQ-213392/A-Unlocking Cord Set - Center Stack Soft Button 95](#_Toc80729423)

[5.7.3.6. DR-REQ-245719/C-Cord Lock Timing Requirements 96](#_Toc80729424)

[1.1.1.1.18 DR-REQ-245725/C-Cord Lock Timing - AC Digital Unlock 98](#_Toc80729425)

[1.1.1.1.19 DR-REQ-354198/A-Re-lock cord after BCB Toggle 98](#_Toc80729426)

[5.7.3.7. Cord Lock/Unlock FMEM Actions (470791; B) 99](#_Toc80729427)

[1.1.1.1.20 DR-REQ-271058/B-Unlocking EVSE FMEM - CSI Stuck Button 99](#_Toc80729428)

[1.1.1.1.21 DR-REQ-271057/A-Unlocking EVSE FMEM - APIM Missing Message 100](#_Toc80729429)

[1.1.1.1.22 DR-REQ-242195/A-FMEM - Unlocking EVSE 101](#_Toc80729430)

[1.1.1.1.23 DR-REQ-281270/C-Cord Lock Fault Alert 101](#_Toc80729431)

[1.1.1.1.24 DR-REQ-242194/B-FMEM - Locking EVSE 102](#_Toc80729432)

[1.1.1.1.25 DR-REQ-333361/A-Cord Lock Fault Alert - Center Stack Display 103](#_Toc80729433)

[5.8. SR-REQ-209498/C-DC Fast Charge 104](#_Toc80729434)

[5.8.1. DR-REQ-221996/B-DC Fast Charge Start Charging Requirements 105](#_Toc80729435)

[5.8.1.1. DR-REQ-242074/A-DCFC BECM Charge Wait 106](#_Toc80729436)

[5.8.1.2. DR-REQ-242118/B-DCFC DCGM Charge Initialization 107](#_Toc80729437)

[5.8.1.3. DR-REQ-242120/A-DCFC BCCM Charge Ready 108](#_Toc80729438)

[5.8.1.4. DR-REQ-242122/B-DCFC DCGM Cable Check and Precharge 110](#_Toc80729439)

[5.8.1.5. DR-REQ-242124/A-DCFC BECM Charge Ready 110](#_Toc80729440)

[5.8.1.6. DR-REQ-242128/B-DCFC BECM Charging 111](#_Toc80729441)

[5.8.1.7. DC Charge FMEM Actions (639904; A) 112](#_Toc80729442)

[1.1.1.1.26 DR-REQ-347986/A-FMEM - DCGM Fault 112](#_Toc80729443)

[1.1.1.1.27 REQ-359296/A-FMEM - BECM Charge Wait Time Out for digital communication 113](#_Toc80729444)

[5.8.2. DR-REQ-221997/A-DC Fast Charge End Charging Requirements 114](#_Toc80729445)

[5.8.3. DR-REQ-242077/A-DC Fast Charge Inhibit Override 114](#_Toc80729446)

[5.8.4. DR-REQ-242121/A-DCFC BECM Isolation Detection Disable 115](#_Toc80729447)

[5.8.5. DR-REQ-312181/B-DC Fast Charge Open Contactor Request for HPCM 116](#_Toc80729448)

[5.8.6. DR-REQ-313715/A-DC Fast Charge - HPCM Close Contactor 117](#_Toc80729449)

[~~5.8.7.~~ ~~DR-REQ-323500/A-DCFC Count for Display~~ 118](#_Toc80729450)

[~~5.8.8.~~ ~~DR-REQ-323501/A-DCFC Count - APIM Display~~ 118](#_Toc80729451)

[6. PIC System Design Diagram (PIC SDD) (200545; A) 119](#_Toc80729452)

[6.1. Plant (200540; A) 119](#_Toc80729453)

[6.2. Control (200541; A) 119](#_Toc80729454)

[7. PIC Derived Requirements (PIC DRs) By Sub-system (200548; A) 119](#_Toc80729455)

[8. HLFR\_PIC\_DRs\_to\_SSFT16\_Electrified\_Vehicle\_Controls 119](#_Toc80729456)

[8.1. DR-REQ-140520/B-Torque Not Available While on Plug 120](#_Toc80729457)

[8.1.1. DR-REQ-326489/A-VMP Shutdown for preventing wheel torque on MHT 121](#_Toc80729458)

[8.2. DR-REQ-140557/C-Plug Status Override 123](#_Toc80729459)

[8.2.1. DR-REQ-140562/B-Is the Vehicle Plugged In Command 126](#_Toc80729460)

[8.2.2. DR-REQ-140559/A-Cluster Message - Plug Override 127](#_Toc80729461)

[8.2.3. DR-REQ-413897/A-Plug Override Recovery 128](#_Toc80729462)

[8.3. DR-REQ-242077/A-DC Fast Charge Inhibit Override 128](#_Toc80729463)

[8.4. DR-REQ-328645/A-DTC - Driving on plug 129](#_Toc80729464)

[8.5. DR-REQ-309265/A-External Charge Fault Display 129](#_Toc80729465)

[8.5.1. DR-REQ-271049/B-EVSE Faulty - Cluster Notification 131](#_Toc80729466)

[8.6. DR-REQ-312181/B-DC Fast Charge Open Contactor Request for HPCM 131](#_Toc80729467)

[8.7. DR-REQ-313715/A-DC Fast Charge - HPCM Close Contactor 133](#_Toc80729468)

[9. HLFR\_PIC\_DRs\_To\_Traction\_Battery\_Controls 133](#_Toc80729469)

[9.1. DR-REQ-207319/A-Battery State of Charge Signal 134](#_Toc80729470)

[9.2. DR-REQ-207320/B-Customer State Of Charge Signal 134](#_Toc80729471)

[9.2.1. DR-REQ-328367/A-CSoC at Charge Complete 135](#_Toc80729472)

[9.3. DR-REQ-242070/B-BECM Charge Wait 136](#_Toc80729473)

[9.4. DR-REQ-214922/B-BECM Charge Ready 137](#_Toc80729474)

[9.5. DR-REQ-235773/A-BECM Charging 138](#_Toc80729475)

[9.6. DR-REQ-271257/A-FMEM - BCCM Fault 139](#_Toc80729476)

[9.7. DR-REQ-271260/A-FMEM - Charge Inhibit Signal 140](#_Toc80729477)

[9.8. DR-REQ-271261/A-FMEM - Charger Ready Status 140](#_Toc80729478)

[9.9. DR-REQ-344077/A-FMEM - EVSE Status Signal 141](#_Toc80729479)

[9.10. DR-REQ-193867/D-BECM Event Wakeups 142](#_Toc80729480)

[9.10.1. DR-REQ-261943/B-Charge Target Reached Event Wakeup 142](#_Toc80729481)

[9.10.2. DR-REQ-262123/D-Charge Requested CAN Sustain 143](#_Toc80729482)

[9.10.3. DR-REQ-314690/C-DC Charge Requested CAN Sustain 145](#_Toc80729483)

[9.11. DR-REQ-238478/A-Hold-Off after Charge Complete 146](#_Toc80729484)

[9.12. DR-REQ-271263/A-FMEM - Charge Target Signal 148](#_Toc80729485)

[9.13. DR-REQ-242074/A-DCFC BECM Charge Wait 149](#_Toc80729486)

[9.14. DR-REQ-242124/A-DCFC BECM Charge Ready 149](#_Toc80729487)

[9.15. DR-REQ-242128/B-DCFC BECM Charging 150](#_Toc80729488)

[9.16. DR-REQ-242121/A-DCFC BECM Isolation Detection Disable 151](#_Toc80729489)

[10. HLFR\_PIC\_DRs\_To\_Trac\_Batt\_Charger\_Controls 152](#_Toc80729490)

[10.1. DR-REQ-140525/A-Inductive Charging Drive Away 152](#_Toc80729491)

[10.2. DR-REQ-140444/A-Start Charging Requirements 153](#_Toc80729492)

[10.2.1. DR-REQ-242070/B-BECM Charge Wait 154](#_Toc80729493)

[10.2.2. DR-REQ-214924/B-BCCM Charge Ready 156](#_Toc80729494)

[10.2.3. DR-REQ-214922/B-BECM Charge Ready 157](#_Toc80729495)

[10.2.4. DR-REQ-235773/A-BECM Charging 158](#_Toc80729496)

[10.2.5. Charging FMEM Actions (470789; C) 158](#_Toc80729497)

[10.2.5.1. DR-REQ-271256/A-FMEM - BECM Fault 158](#_Toc80729498)

[10.2.5.2. DR-REQ-271257/A-FMEM - BCCM Fault 159](#_Toc80729499)

[10.2.5.3. DR-REQ-271258/A-FMEM - Torque Status Signal 159](#_Toc80729500)

[10.2.5.4. DR-REQ-271259/B-FMEM - Gear Position Signal 160](#_Toc80729501)

[10.2.5.5. DR-REQ-271260/A-FMEM - Charge Inhibit Signal 161](#_Toc80729502)

[10.2.5.6. DR-REQ-271261/A-FMEM - Charger Ready Status 162](#_Toc80729503)

[10.2.5.7. DR-REQ-271262/A-FMEM - Battery Charge Ready Status 162](#_Toc80729504)

[10.2.5.8. DR-REQ-344077/A-FMEM - EVSE Status Signal 163](#_Toc80729505)

[10.2.5.9. DR-REQ-346401/A-FMEM - On Board Fault 163](#_Toc80729506)

[10.2.5.10. DR-REQ-347824/A-FMEM - BECM Timeout 164](#_Toc80729507)

[10.2.5.11. DR-REQ-355178/A-FMEM - Charge Target Signal 165](#_Toc80729508)

[10.3. DR-REQ-271256/A-FMEM - BECM Fault 166](#_Toc80729509)

[10.4. DR-REQ-271258/A-FMEM - Torque Status Signal 166](#_Toc80729510)

[10.5. DR-REQ-271259/B-FMEM - Gear Position Signal 167](#_Toc80729511)

[10.6. DR-REQ-271262/A-FMEM - Battery Charge Ready Status 168](#_Toc80729512)

[10.7. DR-REQ-140445/B-Continue Charging 168](#_Toc80729513)

[10.8. DR-REQ-140446/B-End Plug-in Charging 169](#_Toc80729514)

[10.8.1. DR-REQ-358756/A-BECM Charge Complete Declaration 170](#_Toc80729515)

[10.9. DR-REQ-140526/A-End Inductive Charging 171](#_Toc80729516)

[10.10. DR-REQ-140541/A-BCCM Contactor Power Assertion 171](#_Toc80729517)

[10.11. DR-REQ-140542/C-BCCM Contactor Power De-Assertion 172](#_Toc80729518)

[10.12. DR-REQ-140543/A-BCCM Contactor Power Diagnostics 174](#_Toc80729519)

[10.13. DR-REQ-140546/B-Contactor Power- Invalid Contactor Command from BECM 174](#_Toc80729520)

[10.14. DR-REQ-221352/A-Conductive Charging Preferred 175](#_Toc80729521)

[10.15. DR-REQ-235507/B-Raw Plug Status Signal 176](#_Toc80729522)

[10.15.1. DR-REQ-140555/A-Plug Status Fault Detection 177](#_Toc80729523)

[10.16. DR-REQ-137808/C-Types of Charging 179](#_Toc80729524)

[10.16.1. DR-REQ-271039/A-EVSE Not Compatible 181](#_Toc80729525)

[10.16.2. DR-REQ-271040/A-EVSE Faulty 181](#_Toc80729526)

[10.17. DR-REQ-193866/C-BCCM Event Wakeups 182](#_Toc80729527)

[10.17.1. DR-REQ-261818/A-Plug Status Event Wakeup 182](#_Toc80729528)

[10.17.2. DR-REQ-261819/D-Charging Status Change Wake Event 183](#_Toc80729529)

[10.17.3. DR-REQ-261820/B-Charger Power Available Change Wake Event 184](#_Toc80729530)

[10.18. DR-REQ-193486/B-DC Fast Charge - Unlocking EVSE 185](#_Toc80729531)

[10.18.1. DR-REQ-193490/B-DC Fast Charge - Unlock Request 186](#_Toc80729532)

[10.19. DR-REQ-193488/A-DC Fast Charge - Cord Lock During Power Transfer 187](#_Toc80729533)

[10.20. DR-REQ-258010/B-AC Charging Unlock Requirements 187](#_Toc80729534)

[10.20.1. DR-REQ-193483/C-Conductive Charging - Cord Unlock Request 188](#_Toc80729535)

[10.20.2. DR-REQ-193495/C-Conductive Charging - Unlocking Cord Set 189](#_Toc80729536)

[10.20.2.1. DR-REQ-316891/A-Unlocking FMEM - AC Voltage 192](#_Toc80729537)

[10.20.3. DR-REQ-193484/A-CAN Request for Secure Cord Unlock - BCM 192](#_Toc80729538)

[10.20.4. DR-REQ-271247/B-AC Cord Lock - APIM Enable 194](#_Toc80729539)

[10.21. DR-REQ-271059/B-Cord Re-lock strategy for EU 195](#_Toc80729540)

[10.21.1. DR-REQ-369553/A-HEV Wake for cord re-lock 195](#_Toc80729541)

[10.22. DR-REQ-193482/A-Unlocking Cord Set Button - Inlet Port Housing 196](#_Toc80729542)

[10.23. DR-REQ-194504/A-Detection of EVSE Unlock Button 197](#_Toc80729543)

[10.24. DR-REQ-245719/C-Cord Lock Timing Requirements 197](#_Toc80729544)

[10.24.1. DR-REQ-245725/C-Cord Lock Timing - AC Digital Unlock 199](#_Toc80729545)

[10.24.2. DR-REQ-354198/A-Re-lock cord after BCB Toggle 199](#_Toc80729546)

[10.25. DR-REQ-271058/B-Unlocking EVSE FMEM - CSI Stuck Button 200](#_Toc80729547)

[10.26. DR-REQ-271057/A-Unlocking EVSE FMEM - APIM Missing Message 201](#_Toc80729548)

[10.27. DR-REQ-242195/A-FMEM - Unlocking EVSE 202](#_Toc80729549)

[10.28. DR-REQ-281270/C-Cord Lock Fault Alert 202](#_Toc80729550)

[10.29. DR-REQ-242194/B-FMEM - Locking EVSE 203](#_Toc80729551)

[10.30. DR-REQ-221996/B-DC Fast Charge Start Charging Requirements 204](#_Toc80729552)

[10.30.1. DR-REQ-242074/A-DCFC BECM Charge Wait 205](#_Toc80729553)

[10.30.2. DR-REQ-242118/B-DCFC DCGM Charge Initialization 206](#_Toc80729554)

[10.30.3. DR-REQ-242120/A-DCFC BCCM Charge Ready 207](#_Toc80729555)

[10.30.4. DR-REQ-242122/B-DCFC DCGM Cable Check and Precharge 209](#_Toc80729556)

[10.30.5. DR-REQ-242124/A-DCFC BECM Charge Ready 210](#_Toc80729557)

[10.30.6. DR-REQ-242128/B-DCFC BECM Charging 210](#_Toc80729558)

[10.30.7. DC Charge FMEM Actions (639904; A) 211](#_Toc80729559)

[10.30.7.1. DR-REQ-347986/A-FMEM - DCGM Fault 211](#_Toc80729560)

[10.30.7.2. REQ-359296/A-FMEM - BECM Charge Wait Time Out for digital communication 212](#_Toc80729561)

[10.31. DR-REQ-221997/A-DC Fast Charge End Charging Requirements 213](#_Toc80729562)

[11. HLFR\_PIC\_DRs\_to\_Body\_Ctrls 213](#_Toc80729563)

[11.1. DR-REQ-140521/B-Prevention of Gear Shifting on Plug 214](#_Toc80729564)

[11.1.1. DR-REQ-344076/A-FMEM - Arbitrated Plug Status Missing Message for BCM 214](#_Toc80729565)

[11.2. DR-REQ-193484/A-CAN Request for Secure Cord Unlock - BCM 215](#_Toc80729566)

[12. HLFR\_PIC\_DRs\_to\_Telematics\_Controls 217](#_Toc80729567)

[13. HLFR\_PIC\_DRs\_To\_Driver\_Information\_Module 217](#_Toc80729568)

[13.1. DR-REQ-140522/A-Cluster Indication - Charging Mode 217](#_Toc80729569)

[13.2. DR-REQ-234396/A-Cluster Indication - On Plug Tell-tale 218](#_Toc80729570)

[13.3. DR-REQ-140523/A-Cluster Indication - Unplug Vehicle 219](#_Toc80729571)

[13.4. DR-REQ-271048/B-EVSE Not Compatible - Cluster Notification 219](#_Toc80729572)

[13.5. DR-REQ-271049/B-EVSE Faulty - Cluster Notification 220](#_Toc80729573)

[13.6. DR-REQ-140559/A-Cluster Message - Plug Override 220](#_Toc80729574)

[14. HLFR\_PIC\_DRs\_to\_Infotainment\_Controls 221](#_Toc80729575)

[14.1. DR-REQ-213392/A-Unlocking Cord Set - Center Stack Soft Button 222](#_Toc80729576)

[14.2. DR-REQ-271247/B-AC Cord Lock - APIM Enable 223](#_Toc80729577)

[14.3. DR-REQ-333361/A-Cord Lock Fault Alert - Center Stack Display 223](#_Toc80729578)

[15. HLFR\_PIC\_DRs\_to\_SSFT2\_Starting\_Electrical\_Accessory\_PT\_Functions 224](#_Toc80729579)

[15.1. DR-REQ-213756/B-LV Energy Transfer on Charge 224](#_Toc80729580)

[16. Revision History (200554; A) 225](#_Toc80729581)

[17. Appendix Section (200555; A) 225](#_Toc80729582)

# HLFR\_PIC(200530; C)

# Plug-In Charging High Level Function (PIC) (200546; A)

# Document Summary (200547; A)

Author(s): Ryan Hunt

Controlled copy: In EPE Systems VSEM

Abstract/Notes: This HLF pertains to plug-in electric vehicles; PHEV’s, BEV’s and MHT Plug-ins.

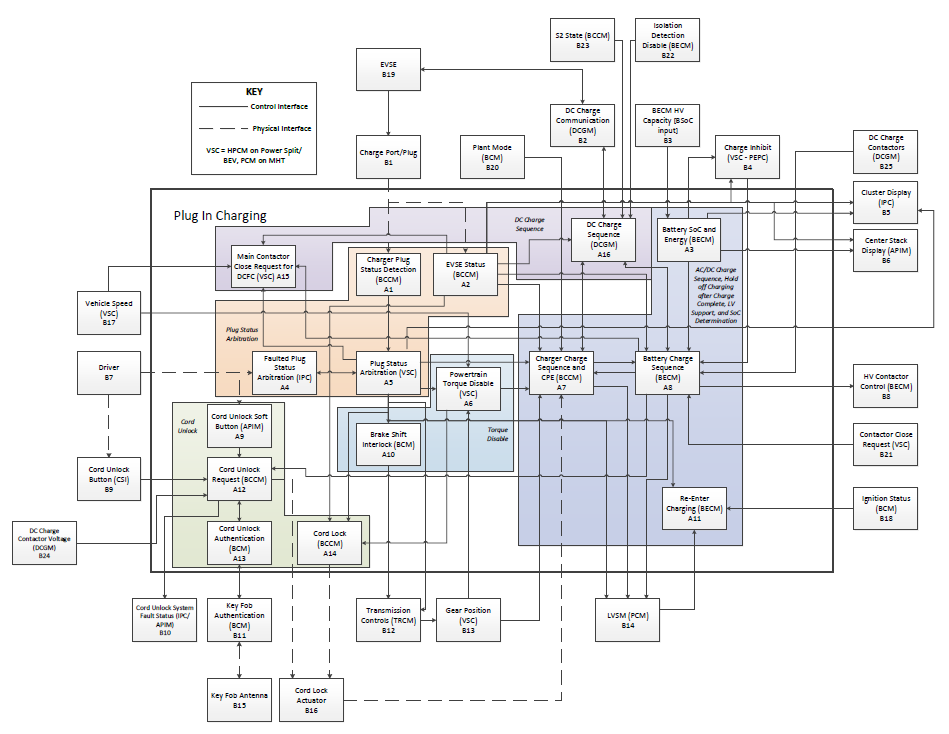
# PIC High Level Design (200542; A)

## Description / Scope (200537; A)

All requirements assume Powersplit or Module Hybrid Transmission (MHT) Plug-In HEV powertrain architectures.

This HLF contains the requirements associated with Plug-in Charging. The requirements will include but not be limited to the following:

* Defining plug in charging
* Conditions for beginning, continuing, ending and exiting charge
* Necessary conditions for disabling vehicle propulsion or gear shifting while on plug
* Behavior of charging after the vehicle has reached a charge complete
* Necessary conditions on battery thermal or cabin thermal conditioning regarding HV state of charge (SOC)
* Definition of Customer SOC and Battery SOC
* Charger plug status and power available detection
* Maintaining 12V battery SOC while on plug with wall power present
* On-Board Diagnostics while Plug-in Charging



**PIC Signal Flow**

****

EVCC

## PIC P-Diagram (200539; A)

### PIC Scope (200531; A)

### PIC Inputs (200532; A)

### PIC Outputs (200533; A)

### PIC Control Factors (200534; A)

### PIC Noise Factors (200535; A)

### PIC Error States (200536; A)

# PIC Ideal Functions (200543; A)

## IF-REQ-271030/A-Driveaway While On Charge

|  |  |  |
| --- | --- | --- |
| **Title**  **Driveaway While On Charge** | **ID**  IF-REQ-271030 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To** | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

The vehicle should prevent torque to the wheels when plugged in.

## IF-REQ-271031/A-State of Charge

|  |  |  |
| --- | --- | --- |
| **Title**  **State of Charge** | **ID**  IF-REQ-271031 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To** | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The vehicle shall clearly indicate the state of charge of the traction battery for both customer and control use.

## IF-REQ-271032/A-Vehicle Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **Vehicle Charging** | **ID**  IF-REQ-271032 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To** | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The charging system shall only begin charging when it is safe for the vehicle to do so.

## IF-REQ-271033/A-Low Voltage Support

|  |  |  |
| --- | --- | --- |
| **Title**  **Low Voltage Support** | **ID**  IF-REQ-271033 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To** | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The charging system should support the low voltage battery when the vehicle is on plug and charging the high voltage battery.

## IF-REQ-271034/A-Plug Status

|  |  |  |
| --- | --- | --- |
| **Title**  **Plug Status** | **ID**  IF-REQ-271034 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To** | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The vehicle shall be able to detect changes in plug state.

## IF-REQ-271036/A-Hold-Off After Charge Complete

|  |  |  |
| --- | --- | --- |
| **Title**  **Hold-Off After Charge Complete** | **ID**  IF-REQ-271036 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To** | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The vehicle will not restart charging after reaching charge complete unless the charging conditions are reset.

## IF-REQ-271037/B-Cord Unlock

|  |  |  |
| --- | --- | --- |
| **Title**  **Cord Unlock** | **ID**  IF-REQ-271037 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To** | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The vehicle will be capable of unlocking a locked charging cord on specific programs or in specific markets. The cord lock shall be independent of the door locks.

## IF-REQ-271038/A-DC Fast Charge

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge** | **ID**  IF-REQ-271038 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To** | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

For specific programs, the vehicle will be capable of charging with a DC fast charger. The charging system will not begin fast charging until it is safe to do so.

# PIC System/Derived Requirements (PIC SRs) (200544; A)

## SR-REQ-137807/D-Drive Away While on Charge

|  |  |  |
| --- | --- | --- |
| **Title**  **Drive Away While on Charge** | **ID**  SR-REQ-137807 | **Revision**  D  **Status** |
| **Meets** | | |
| **Applies To**  003400\_HEV - Electrified Powertrain System | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  IF-REQ-271030/A-Driveaway While On Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CFVlV$nxx3NrTD)] | **Down-Links**  DR-REQ-140520/B-Torque Not Available While on Plug[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SddpYTeZx3NrTD)]  DR-REQ-140522/A-Cluster Indication - Charging Mode[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=B_UVBLAox3NrTD)]  DR-REQ-234396/A-Cluster Indication - On Plug Tell-tale[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TsbdMRRRx3NrTD)]  DR-REQ-140523/A-Cluster Indication - Unplug Vehicle[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ReXVBLAox3NrTD)]  DR-REQ-140525/A-Inductive Charging Drive Away[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xmWVBLAox3NrTD)]  DR-REQ-140557/C-Plug Status Override[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TQuB38H7x3NrTD)]  DR-REQ-140521/B-Prevention of Gear Shifting on Plug[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i$axmcJcx3NrTD)] | |
| **Verified By Test Method(s)**  TST-REQ-266355/B-Drive away while on charge | | |

**Description**

**Drive Away While on Charge**

The vehicle shall prevent driving away while on plug and shall discontinue inductive charging if the vehicle is inductive charging and the vehicle is shifted out of park.

Additionally, if the raw plug status (PlgActv\_D\_ActlChrgr) is faulted, there shall be a cluster interface with the customer to determine the plug-in status of the vehicle. The customer’s response will be reported on CAN (PlgActvArb\_B\_Actl).

### DR-REQ-140520/B-Torque Not Available While on Plug

|  |  |  |
| --- | --- | --- |
| **Title**  **Torque Not Available While on Plug** | **ID**  DR-REQ-140520 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links**  DR-REQ-326489/A-VMP Shutdown for preventing wheel torque on MHT[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=y1XtIF4ax3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**Torque Not Available While on Plug**

The VSC shall prevent Torque to the wheels if:

1. The vehicle is plugged in (PlgActvArb\_B\_Actl = ON PLUG)

AND

1. The vehicle speed is less than 5 mph (calibratable)

*Rationale/Notes*

*Raw plug status is determined by PlgActv\_D\_ActlChrgr. If raw plug status is faulted, use the arbitrated plug status PlgActvArb\_B\_Actl, determined by the logic in DR-REQ-140557.*

*~~NA customers are adverse to their vehicle being disabled an assailant approaching their vehicle and disabling it while they are in Drive, thus the vehicle is required to be in Park before disabling torque.~~ Per FMVSS 305, this may not be true. Ford has asked NHTSA for clarification on if they can wait until the vehicle is in Park before disabling torque. Until then, Ford vehicles in NA will follow the same regulation strategy as EU and China.*

*EU and China regulatory requirements require only that the vehicle speed is guaranteed to be below a threshold so that torque is not disabled while the vehicle is in motion.*

*The table below is for if NHTSA’s response allows Ford to wait until Gear Position is Park for NA.*

|  |  |  |  |
| --- | --- | --- | --- |
| ***Entry Condition*** | ***North America*** | ***Europe*** | ***China*** |
| *Gear = P* | *X* |  |  |
| *Speed <5mph (calibratable)* |  | *X* | *X* |

*For North America, the regulation is captured under FMVSS 305 S5.4.6.3. The text reads:*

*“If the on-board electric energy storage device can be externally charged, vehicle movement of more than 150 mm by its own propulsion system shall not be possible as long as the charge connector of the external electric power supply is physically connected to the vehicle charge inlet in a manner that would permit charging of the electric energy storage device.”*

*For Europe, the regulation is in R100 S5.3 and reads:*

*“If the on-board REESS can be externally charged by the user, vehicle movement by its own propulsion system shall be impossible as long as the connector of the external electric power supply is physically connected to the vehicle inlet. This requirement shall be demonstrated by using the connector specified by the car manufacturer.”*

*For China, there are two sections related to preventing propulsion. The first is GBT19571 S4.2.1.2 and reads:*

*“For the vehicles supplied with outside recharging devices, when the vehicles are connected to the outside circuits (i.e. power line, outside charger), the vehicle shall not be moved by its self-driving system.”*

*The second is GBT18384.2 S4.2 and reads:*

*“If the on-board REESS of the vehicle propulsion system can be charged via an off-board power source, when the user physically connects the vehicle to the off-board electric power supply, vehicle motion by its own propulsion system shall be impossible.”*

#### DR-REQ-326489/A-VMP Shutdown for preventing wheel torque on MHT

|  |  |  |
| --- | --- | --- |
| **Title**  **VMP Shutdown for preventing wheel torque on MHT** | **ID**  DR-REQ-326489 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140520/B-Torque Not Available While on Plug[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SddpYTeZx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The VSC shall transition to a “shutdown” state if the following conditions are true:

1. The vehicle is not in Park (GearLvrPos\_D\_Actl != 0x0)

AND

1. The vehicle is on plug (PlgActvArb\_B\_Aclt = 0x1)

AND

1. Vehicle speed is below 5 kph (calibratable)

The VSC shall ignore start up requests while the following conditions are true:

1. The vehicle is not in Park (GearLvrPos\_D\_Actl != 0x0)

AND

1. The vehicle is on plug (PlgActvArb\_B\_Aclt = 0x1)

*Rationale/Notes*

*The HEV system controller does not have control over wheel torque in MHT configured vehicles. As such, it is possible for the HEV controller to be in a Torque disabled state, but for wheel torque to still be possible while on plug, which will violate DR-REQ-140520 and FMVSS 305.*

*Placing the vehicle into a shut down state when on plug and not in Park allows the vehicle to meet FMVSS requirements within the capability of the HEV system controller. If the driver shifts, to Park, the VSC can allow power up requests again, as the BTSI will prevent the vehicle from being able to move, and it will give the customer power for auxiliary systems, such as climate control.*

### DR-REQ-140521/B-Prevention of Gear Shifting on Plug

|  |  |  |
| --- | --- | --- |
| **Title**  **Prevention of Gear Shifting on Plug** | **ID**  DR-REQ-140521 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  191001\_Body Control Module | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links**  DR-REQ-344076/A-FMEM - Arbitrated Plug Status Missing Message for BCM[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=T4WxmcJcx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**Prevent Gear Shifting on Plug**

The BCM shall disable the BTSI signal to the shift module (BrkTrnShifLck\_B\_Stat = 0x0) if the arbitrated plug status signal from the HPCM/PCM is “On Plug” (PlgActvArb\_B\_Actl = 0x1).

If the signal is missing, the default value in the BCM for this signal will be plugged in.

*Notes/Rationale:*

*Input:*

* *PlgActvArb\_B\_Actl*

*Output*

* *Brake Shift Interlock Control (BrkTrnShifLck\_B\_Stat)*

*Initially, value in the BCM will be initialized to on plug until a valid signal is received. This is based on reviews with the BTSI team and his discussions with the transmission team.*

#### DR-REQ-344076/A-FMEM - Arbitrated Plug Status Missing Message for BCM

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Arbitrated Plug Status Missing Message for BCM** | **ID**  DR-REQ-344076 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  191001\_Body Control Module | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140521/B-Prevention of Gear Shifting on Plug[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i$axmcJcx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Arbitrated Plug Status is Missing, the BCM shall assume it as “On Plug” (PlgActvArb\_B\_Actl = 0x1) for purposes of setting the BTSI (See DR-REQ-140521)

*Rationale/Notes:*

*In order to prevent the vehicle from shifting out of park while on plug, the BCM must assume the vehicle is on plug if the Arbitrated Status is missing.*

### DR-REQ-378360/A-Shift to Park while On Plug

|  |  |  |
| --- | --- | --- |
| **Title**  **Shift to Park while On Plug** | **ID**  DR-REQ-378360 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The VSC shall shift the vehicle to Park if the following conditions are true:

1. The Arbitrated Plug Status is “On Plug” (PlgActvArb\_B\_Actl = 0x1)

AND

1. The vehicle speed is below a calibratable threshold

AND

1. The vehicle is NOT in factory mode (LifeCycMde\_D\_Actl != 0x1 FACTORY)

*Rationale/Notes*

*With the introduction of One Pedal Drive, it is possible for the vehicle to roll if torque is disabled while the OPD system is requesting torque. Shifting to Park will cover both OPD and MHT applications, where the motor is not in complete control of wheel torque.*

*This requirement only applies to vehicles with a shift by wire system.*

*This function should be prevented if the vehicle is in factory mode so that the plant can test charging in Neutral while the vehicle is on the line.*

### DR-REQ-140522/A-Cluster Indication - Charging Mode

|  |  |  |
| --- | --- | --- |
| **Title**  **Cluster Indication - Charging Mode** | **ID**  DR-REQ-140522 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Customer Indication – Charging Mode**

The Cluster shall display a “charging type” message when the Charger Input Power Mode (ChrgrInPwMde\_D\_Actl) from the BCCM is AC, DC, or Inductive Charging.

*Rationale/Notes*

*The cluster should display the charging type based the status of ChrgrInPwMde\_D\_Actl*

* *0x0 – EVSE Not Detected*
* *0x1 – EVSE Paused*
* *0x2 – Digital Comm Detected*
* *0x3 – AC Basic*
* *0x4 – AC Digital*
* *0x5 – DC Charging*
* *0x6 – Inductive Charging*
* *0x7 – EVSE Not Compatible*
* *0x8 – EVSE Faulty*

*No icon should be displayed if the charging type is EVSE Not Detected.*

### DR-REQ-234396/A-Cluster Indication - On Plug Tell-tale

|  |  |  |
| --- | --- | --- |
| **Title**  **Cluster Indication - On Plug Tell-tale** | **ID**  DR-REQ-234396 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Customer Indication – On Plug Tell-tale**

The Cluster shall display an icon or tell-tale when the Arbitrated Plug Status (PlgActvArb\_B\_Actl) from the HPCM is ON PLUG. If the signal is missing, the cluster shall default to OFF PLUG.

*Rationale/Notes*

*The cluster should display the charging type based the status of PlgActtvArb\_B\_Actl*

* *0x0: OFF PLUG*
* *0x1: ON PLUG*

*The cluster will not display an icon if the arbitrated plug status is “Off Plug”*

### DR-REQ-140523/A-Cluster Indication - Unplug Vehicle

|  |  |  |
| --- | --- | --- |
| **Title**  **Cluster Indication - Unplug Vehicle** | **ID**  DR-REQ-140523 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Cluster Indication – Unplug Vehicle**

The instrument cluster shall display the "Unplug Vehicle to Start"

or equivalent messages based on the input provided by the BCM.

*Notes/Rationale*

*See HLFR\_DIDC SR-REQ-012987 for details on the unplug vehicle to start message*

### DR-REQ-140525/A-Inductive Charging Drive Away

|  |  |  |
| --- | --- | --- |
| **Title**  **Inductive Charging Drive Away** | **ID**  DR-REQ-140525 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Inductive Charging Drive Away**

The BCCM shall disable inductive charging if Torque Status (PwPckTq\_D\_Stat) is either Starting in Progress (0x2) or Torque Available (0x3).

*Note: The charger will need to communicate to the IRCM that the customer is trying to drive away and inductive charging will need to be disabled. We need to determine if there is enough time to ensure that inductive charging can be disabled before the vehicle is in motion.*

### DR-REQ-140557/C-Plug Status Override

|  |  |  |
| --- | --- | --- |
| **Title**  **Plug Status Override** | **ID**  DR-REQ-140557 | **Revision**  C  **Status** |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links**  DR-REQ-140562/B-Is the Vehicle Plugged In Command[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SgR1wlK6x3NrTD)]  DR-REQ-140559/A-Cluster Message - Plug Override[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=h3cVRD6_x3NrTD)]  DR-REQ-413897/A-Plug Override Recovery[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=DlnB38H7x3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**Plug Status Override**

If the raw plug status is Missing, Unknown, or Faulted (PlgActv\_D\_ActlChrgr = 0x2 or 0x3), and a vehicle start is requested the VSC shall send an override request to the cluster (ChkPlgToStrt\_D\_Dsply). The VSC shall override the plug status based on feedback from the customer via the cluster (PlgOvrrdStrt\_D\_Cmd), according to the flow diagram and state table below:

See control flow below.



**State Table for PCM/HPCM plug status as follows:**

|  |  |  |
| --- | --- | --- |
| Inputs To PCM  X = Don't Care | | Outputs From  PCM |
| PlgActv\_D\_ActlChrgr | PlgOvrrdStrt\_D\_Cmd | PlgActvArb\_B\_Actl |
| 0x1: On Plug | X | ON Plug |
| 0x0: Off Plug | X | OFF Plug |
| Missing | Customer Confirms OFF Plug | OFF Plug |
| Missing | Customer Indicates ON Plug | ON Plug |
| Missing | No Response  (Null State, Missing or Invalid) | ON Plug |
| 0x3: Fault | Customer Confirms OFF Plug | OFF Plug |
| 0x3: Fault | Customer Indicates ON Plug | ON Plug |
| 0x3: Fault | No Response  (Null State, Missing or Invalid) | ON Plug |
| 0x2: Unknown | Customer Confirms OFF Plug | OFF Plug |
| 0x2: Unknown | Customer Indicates ON Plug | ON Plug |
| 0x2: Unknown | No Response  (Null State, Missing or Invalid) | ON Plug |

Signal Definition

Signal Name: PlgActvArb\_B\_Actl

Size: 1 bits

Values:

* 0x0 – Off Plug
* 0x1 – On Plug

Resolution: Bool

Rate: 100 msec

Tx: HPCM/PCM

Rx: IPC, BCM

*Rationale/Notes:*

*It is desired to find a way to transition into a vehicle mode which doesn't require a key-off before next start request. Intended function is that the vehicle could transitions into PwPckOn\_TqNotAvailable, then wait for the next vehicle start request.*

*Propose details of this be added to PUPD. This was discussed with the PHEV charge system team and there are multiple checks to determine on plug and it was recommended this only apply to missing or faulted plug status.*

*Inputs:*

* *PlgActv\_D\_ActlChrgr*
* *PlgOvrrdStrt\_D\_Cmd*

*Output*

* *PlgActvArb\_B\_Actl*

*Suggest HPCM/PCM initialize PlgActvArb\_B\_Actl to on plug to avoid any potential issues with late or missing plug status from the charger.*

#### DR-REQ-140562/B-Is the Vehicle Plugged In Command

|  |  |  |
| --- | --- | --- |
| **Title**  **Is the Vehicle Plugged In Command** | **ID**  DR-REQ-140562 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140557/C-Plug Status Override[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TQuB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Request Plug Status Override**

The VSC shall send a message to the cluster requesting the Plug Status Override display when

* The raw plug status is Faulty or Unknown(PlgActv\_D\_ActlChrgr = 0x2, 0x3)

AND

* A Vehicle Start is requested

Signal Definition

Signal Name: ChkPlgtoStrt\_D\_Dsply

Size: 2 bits

Values:

* 0x0 – No Message Display
* 0x1 – Check Plug to Start
* 0x2 – Is vehicle unplugged prompt
* 0x3 – Not used

Resolution: Discrete

Rate: 100 msec

Tx: HPCM

Rx: IPC

#### DR-REQ-140559/A-Cluster Message - Plug Override

|  |  |  |
| --- | --- | --- |
| **Title**  **Cluster Message - Plug Override** | **ID**  DR-REQ-140559 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140557/C-Plug Status Override[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TQuB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Cluster Message – Plug Override**

The instrument cluster shall display a message and provide a feedback option to the customer that enables the customer to confirm the vehicle is unplugged from the wall based on the VSC input. The cluster will send the feedback in the Plug Override Start Command signal to the HPCM.

This signal shall include the following states:

* Null State (no customer response)
* Customer response indicating the vehicle is plugged in (don't over-ride plug status)
* Customer response indicating the vehicle is not plugged in (over-ride plug status)

Signal Definition

Signal Name: PlgOvrrdStrt\_D\_Cmd

Size: 2 bits

Values:

* 0x0 – Null
* 0x1 – Don’t Override Plug Status
* 0x2 – Override Plug Status
* 0x3 – Not used

Resolution: Discrete

Rate: 1000 msec EP

Tx: IPC

Rx: HPCM

#### DR-REQ-413897/A-Plug Override Recovery

|  |  |  |
| --- | --- | --- |
| **Title**  **Plug Override Recovery** | **ID**  DR-REQ-413897 | **Revision**  A  **Status** |
| **Meets** | | |
| **Applies To** | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140557/C-Plug Status Override[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TQuB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the VSC is overriding the plug status and the raw plug status changes to a non-faulted value, the VSC shall stop overriding the plug status and change the arbitrated plug status to reflect the raw value.

*Rationale/Notes*

*Raw Plug Status: PlgActv\_D\_ActlChrgr*

*Arbitrated Plug Status: PlgActvArb\_B\_Actl*

*Plug override is a failure mode case. If the failure is resolved (in this case, the raw plug status changes to On Plug or Off Plug) then the vehicle should recover from the failure case and follow the raw status.*

### DR-REQ-328645/A-DTC - Driving on plug

|  |  |  |
| --- | --- | --- |
| **Title**  **DTC - Driving on plug** | **ID**  DR-REQ-328645 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The VSC shall set a DTC for driving while on plug if the following conditions are true:

1. The vehicle is on plug (PlugActvArb\_B\_Actl = 0x1)

AND

1. The vehicle speed is above a calibratable threshold for a calibratable amount of time
   1. Default cals: above 3.2 kph for 1 second

*Rationale/Notes*

### Referenced Requirements (470634; B)

## SR-REQ-137812/A-State of Charge Definition

|  |  |  |
| --- | --- | --- |
| **Title**  **State of Charge Definition** | **ID**  SR-REQ-137812 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  003400\_HEV - Electrified Powertrain System | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links**  DR-REQ-207320/B-Customer State Of Charge Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iZZtphjEx3NrTD)]  DR-REQ-207319/A-Battery State of Charge Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CLRZ6Pnhx3NrTD)] | |
| **Verified By Test Method(s)**  TST-REQ-266356/A-Fully Charged Battery | | |

**Description**

**State of Charge Definition**

The Plug In Charging System shall clearly convey the Customer State of Charge and how it relates to the Battery State of Charge for PHEV’s and BEV’s.

### DR-REQ-207319/A-Battery State of Charge Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **Battery State of Charge Signal** | **ID**  DR-REQ-207319 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137812/A-State of Charge Definition[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xyWVw6x1x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Battery State of Charge Signal**

The BECM shall calculate the true battery state of charge as a percent of total available battery energy and broadcast it on the CAN bus.

Signal Definition

Signal Name: BattTracSoc2\_Pc\_Actl

Size: 14 bits

Range: 0-163.81 %

Resolution: 0.01 %

0xFFE – No Data Exists

0xFFF – Faulty

Rate: 100 msec

Tx: BECM

Rx: HPCM, TCU, PCM, ECM

### DR-REQ-207320/B-Customer State Of Charge Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **Customer State Of Charge Signal** | **ID**  DR-REQ-207320 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137812/A-State of Charge Definition[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xyWVw6x1x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall calculate the customer state of charge as a percent of battery energy available for driving and broadcast it onto the CAN bus.

Signal Definition

Signal Name: BattTracSoc\_Pc\_Dsply

Size: 8 bits

Range: 0-126.5 %

Resolution: 0.5 %

0xFE – No Data Exists

0xFF – Faulty

Rate: 100 msec

Tx: BECM

Rx: BCCM, IPC, APIM, DCGM, TCU, HPCM, PCM, ECM

**Rationale/Notes**

*CSoC is the state of charge that is seen by the customer, and it represents the energy used for driving. In PHEVs, this is the portion of the battery used for Charge Deplete Mode, and it should be 0% when the customer enters Charge Sustain Mode.*

#### DR-REQ-328367/A-CSoC at Charge Complete

|  |  |  |
| --- | --- | --- |
| **Title**  **CSoC at Charge Complete** | **ID**  DR-REQ-328367 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

While the vehicle is charging, the BECM shall set the CSoC (BattTracSoc\_Pc\_Dsply) to a value less than 100%. The BECM shall set CSoC to 100% when it declares “Charge Complete” (BattChrgRdyStat\_D\_Actl = 0x4)

*Notes/Rationale*

*Normally, the BECM rounds the CSoC to the nearest integer value. However, in the constant voltage portion of charging (near top of charge), it can to take up to 20 minutes to get from 99% to “Charge Complete”. During this time, it is best to hold CSoC at 99% instead of rounding to the nearest integer and reaching 100% before the BECM declares charge complete.*

## SR-REQ-137806/C-Conditions for Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **Conditions for Charging** | **ID**  SR-REQ-137806 | **Revision**  C  **Status** |
| **Meets** | | |
| **Applies To**  003400\_HEV - Electrified Powertrain System | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links**  DR-REQ-140542/C-BCCM Contactor Power De-Assertion[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SQV1BTiOx3NrTD)]  DR-REQ-140446/B-End Plug-in Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=y4R1Cnw4x3NrTD)]  DR-REQ-140546/B-Contactor Power- Invalid Contactor Command from BECM[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iIV5CMTnx3NrTD)]  DR-REQ-140445/B-Continue Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iVb5rnSlx3NrTD)]  DR-REQ-193867/D-BECM Event Wakeups[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ipVtROnMx3NrTD)]  DR-REQ-140543/A-BCCM Contactor Power Diagnostics[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=BiXVRD6_x3NrTD)]  DR-REQ-221352/A-Conductive Charging Preferred[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CXadzKqQx3NrTD)]  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)]  DR-REQ-140526/A-End Inductive Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=BbQVBLAox3NrTD)]  DR-REQ-140541/A-BCCM Contactor Power Assertion[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xFeVRD6_x3NrTD)] | |
| **Verified By Test Method(s)**  TST-REQ-266357/B-Conditions for Charging | | |

**Description**

**Conditions for Charging**

The Plug In Charging System shall begin charging once all conditions from the BECM, BCCM, and HPCM are met to begin charging. Charging shall continue as long as the conditions to continue charging are met. Charging shall end if any of the conditions from the BECM, BCCM, or HPCM to end charging are met.

Additionally, the vehicle shall broadcast a CAN signal that contains the charging mode to any modules that require knowledge of charging mode.

### DR-REQ-140444/A-Start Charging Requirements

|  |  |  |
| --- | --- | --- |
| **Title**  **Start Charging Requirements** | **ID**  DR-REQ-140444 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links**  DR-REQ-214922/B-BECM Charge Ready[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CkRxJm5Vx3NrTD)]  DR-REQ-271257/A-FMEM - BCCM Fault[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ySTl2oFxx3NrTD)]  DR-REQ-271258/A-FMEM - Torque Status Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CDXl2oFxx3NrTD)]  DR-REQ-214924/B-BCCM Charge Ready[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=yvbpMlh2x3NrTD)]  DR-REQ-271260/A-FMEM - Charge Inhibit Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SrUl2oFxx3NrTD)]  DR-REQ-271261/A-FMEM - Charger Ready Status[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ibXl2oFxx3NrTD)]  DR-REQ-271262/A-FMEM - Battery Charge Ready Status[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=yPZl2oFxx3NrTD)]  DR-REQ-242070/B-BECM Charge Wait[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=JpTp7YiYx3NrTD)]  DR-REQ-271259/B-FMEM - Gear Position Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iiapYTeZx3NrTD)]  DR-REQ-235773/A-BECM Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TNXdtlbXx3NrTD)]  DR-REQ-344077/A-FMEM - EVSE Status Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=jJZxmcJcx3NrTD)]  DR-REQ-271256/A-FMEM - BECM Fault[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iiVl2oFxx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**Start Charging**

The BCCM shall begin charging (ChrgrRdyStat\_D\_Actl = 0x3) if the following conditions are true:

1. The BCCM Charger Ready Status is ‘Ready’ (ChrgrRdyStat\_D\_Actl = 0x1)

And

1. The BECM Battery Charge Ready Status is ‘Charging’ (BattChrgRdyStat\_D\_Actl = 0x3)

And

1. The BECM is requesting a voltage (BattChrg\_U\_Rq > 0)

*Note 1: BCCM will not go to ready if the vehicle is not in ‘Park’.*

*Note 2: Expected that the vehicle will stay at Top of Charge on a BEV unless it falls down below 96.5%.*

#### DR-REQ-242070/B-BECM Charge Wait

|  |  |  |
| --- | --- | --- |
| **Title**  **BECM Charge Wait** | **ID**  DR-REQ-242070 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**BECM Charge Wait**

The BECM shall transition to “Charge Wait” when the following system conditions are true:

1. The HPCM Charge Inhibit status is NOT “Inhibit Charging” (BattChrgInhbt\_D\_Rq != 0x01)

AND

1. The Charger Mode is Digital Comm Detected, AC Basic, AC Digital, DC Charge, or Inductive Charging (ChrgrInPwMde\_D\_Actl = 0x2, 0x3, 0x4, 0x5, 0x6)

AND

1. Either
   1. Battery needs charging (SOC <98% calibratable) AND the HPCM Charge Inhibit status is NOT “Maintain Target SoC” (BattChrgInhbt\_D\_Rq !- 0x03)

OR

* 1. The low voltage support is required (ULoSrcOnPlg\_B\_Cmd = 0x1)

OR

* 1. The contactors are requested closed (BattTracCnnct\_D\_Rq = 0x1) AND the contactors are closed (BattTracCnnct\_D\_Cmd = 0x1)

AND

1. The Charger Ready Status is NOT “ChargerFault” (ChrgrRdyStat\_D\_Actl !=0x2)

AND

1. The BECM is ready to transfer to “Charge Wait”

AND

1. An HEV wake has occurred within a calibratable time span.

**Rationale/Notes**

*The Charge Inhibit flag from the HPCM is used to hold off charging until a value charge window has been reached.*

#### DR-REQ-214924/B-BCCM Charge Ready

|  |  |  |
| --- | --- | --- |
| **Title**  **BCCM Charge Ready** | **ID**  DR-REQ-214924 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**BCCM Charge Ready**

The BCCM shall transmit “Ready to Charge” when the following system conditions are true:

1. The PCM gear position is in Park (GearLvrPos\_D\_Actl = 0x0)

OR

The PCM gear position is in Neutral (GearLvrPos\_D\_Actl = 0x2) AND the vehicle is in Plant Mode (LifeCycMde\_D\_Actl = 0x1 FACTORY)]

AND

1. The HPCM Power Pack Torque Status is not in a torque producing mode (i.e., PwPckTq\_D\_Stat = 0x0, 0x1, or 0x2)

AND

1. The Battery Charge Ready Status is “Battery Charge Wait” (BattChrgRdyStat\_D\_Actl = 0x1)

AND

1. The cord lock status is “Locked” (ChrgCordLck\_D\_Stat = 0x2) (European vehicles only)

AND

1. The BCCM is ready to transition to “Ready to Charge”

*Notes/Rationale*

*The charge waits for the vehicle to be in Park and not in a torque producing mode before charging. If the vehicle moves and pulls out the charge cord unexpectedly while transferring energy, there is a risk of an arc or weld that could damage the charging system or the vehicle.*

*The requirement for being in Park can be overridden if the vehicle is in Neutral and in Plant Mode. This is to allow the plant to test the charging system while the vehicle is on the manufacturing line, instead of testing at EOL.*

#### DR-REQ-214922/B-BECM Charge Ready

|  |  |  |
| --- | --- | --- |
| **Title**  **BECM Charge Ready** | **ID**  DR-REQ-214922 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall transmit “Charge Ready” when the following system conditions are true:

1. The HV battery has not exceeded a calibratable SoC threshold for this charge cycle.

AND

1. The BCCM Charge Ready status (ChrgrRdyStat\_D\_Actl = 0x1) is “Charger Ready”

AND

1. The Charger CPE is “Enabled” (ChrgrCnnctPwr\_B\_Stat = 0x1)

AND

1. The BECM is ready to transition to “Charge Ready”

*Rationale/Note*

*These requirements are from a system level only – the BECM may have additional internal parameters that prevent it from transitioning to “Charge Ready” even if all of the above conditions are met.*

*The first condition is meant to prevent the BECM from constantly initiating charge sequence due to SoC bleed off or preconditioning. SR-REQ-137810 covers the situations in which this condition can be overruled.*

#### DR-REQ-235773/A-BECM Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **BECM Charging** | **ID**  DR-REQ-235773 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall transition to “Charging” when the following system conditions are true:

1. The BCCM charge status is “Charge Ready” (ChrgrRdyStat\_D\_Actl = 0x1)

AND

1. The BECM charge status is “Charge Ready” (BattChrgRdyStat\_D\_Actl = 0x2)

AND

1. Precharge sequence has been completed

AND

1. The BECM is ready to transition to “Charging”

#### Charging FMEM Actions (470789; C)

##### DR-REQ-271256/A-FMEM - BECM Fault

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - BECM Fault** | **ID**  DR-REQ-271256 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the BECM status is Missing or "Faulty" (BattChrgRdyStat\_D\_Actl = 0x5), the BCCM will stop charging and go to "Not Ready" (ChrgrRdyStat\_D\_Actl = 0x0).

##### DR-REQ-271257/A-FMEM - BCCM Fault

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - BCCM Fault** | **ID**  DR-REQ-271257 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the BCCM status message is missing or "Faulty" (ChrgrRdyStat\_D\_Actl = 0x2), the BECM will stop charging and go to "Not Ready" (BattChrgRdyStat\_D\_Actl = 0x0).

##### DR-REQ-271258/A-FMEM - Torque Status Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Torque Status Signal** | **ID**  DR-REQ-271258 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Power Pack Torque Status signal (PwPckTq\_D\_Stat) is missing and the HEV Wake line is high, the charger will treat the signal as "Power Pack on Torque Available (PwPckTq\_D\_Stat = 0x3).

If the Power Pack Torque Status signal (PwPckTq\_D\_Stat) is missing and the HEV Wake line is low, the charger will treat the signal as the last assumed value.

*Rationale/Notes*

*If the HEV wake is high, the charger can assume the vehicle is on, and it should assume torque is available and prevent charging for safety.*

*If the HEV wake is low, the last assumed value is the previous value that the charger either received or assumed (if for example HEV wake is high and the signal is missing). This is to avoid a situation where the BCCM sees a missing message, assumes Torque Available and stops charging, but then upon shut down it then assumes Torque not available, wakes up the module, and begins charging, only to go back to assuming torque available. By taking the last assumed state, the charger can safely charge after waking up the HEV powertrain without charging interruption.*

##### DR-REQ-271259/B-FMEM - Gear Position Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Gear Position Signal** | **ID**  DR-REQ-271259 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the gear position signal (GearLvrPos\_D\_Actl) is missing and the HEV Wake is high, the charger should treat the signal as NOT in park (GearLvrPos\_D\_Actl != P).

If the gear position signal (GearLvrPos\_D\_Actl) is missing and the HEV Wake is low, the charger should treat the signal as its last known value.

If the gear position signal is “Unknown” (GearLvrPos\_D\_Actl = 0xE), the charger shall treat the signal as its last known value for 500ms (calibratable). After 500ms (calibratable), the charger shall treat the signal as missing per the above strategy.

If the gear position signal is “Neutral” (GearLvrPos\_D\_Actl = 0x2), the charger shall treat the signal as its last known value for 500ms (calibratable). After 500ms (calibratable), the charger shall treat the signal as its true value.

*Rationale/Notes*

*If the signal is missing and the HEV wake is high, the charger should assume the vehicle could be on or in motion and should not allow charging for safety.*

*If the signal is missing and the HEV wake is low, the charger should assume the vehicle is powered off and can charge if the last known value will allow charging.*

*On some strategies, the gear position signal may be “Neutral” for <100ms when the transmitting module wakes up. The BCCM needs to be robust to these short signal changes to prevent charge interruption. We are currently pursuing a strategy change to make sure this is “Unknown” instead of “Neutral” for future programs. Once this change is made, the requirement to filter “Neutral” will be removed.*

##### DR-REQ-271260/A-FMEM - Charge Inhibit Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Charge Inhibit Signal** | **ID**  DR-REQ-271260 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Charge Inhibit Signal is missing (BattChrgInhbt\_D\_Rq) and HEV wake is high, the BECM should treat the signal as “Enable\_Charging” (BattChrgInhbt\_D\_Rq = 0x0).

If the Charge Inhibit Signal is missing (BattChrgInhbt\_D\_Rq) and HEV wake is low, the BECM should treat the signal as its last known value.

*Rationale/Notes*

*Since the HPCM is off for the majority of charging, the BECM should assume last known value if the signal is missing.*

*If the inhibit signal is missing, the BECM should assume that charging is allowed. While this is counterintuitive with the FMEM strategies for Gear Position and Torque Status (which assume the value that does not allow charging), from a system perspective this is acceptable. Future programs may have the Inhibit signal originate from a difference source, in which case this distinction will be important.*

##### DR-REQ-271261/A-FMEM - Charger Ready Status

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Charger Ready Status** | **ID**  DR-REQ-271261 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the charger ready status (ChrgrRdyStat\_D\_Actl) is missing, the BECM will treat the signal as "Faulted" (ChrgrRdyStat\_D\_Actl = 0x2).

*Rationale/Notes*

*The BECM should treat a missing charger ready status as faulted in order to avoid and infinite loop that sends a sustain to the whole HEV wake line.*

##### DR-REQ-271262/A-FMEM - Battery Charge Ready Status

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Battery Charge Ready Status** | **ID**  DR-REQ-271262 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Battery Charge Ready Status (BattChrgRdyStat\_D\_Actl) is missing, the charger will treat the signal as "Faulted" (BattChrgRdyStat\_D\_Actl = 0x5).

*Rationale/Notes*

*The charge can simply treat a missing BECM charge ready status as “not ready”, allowing it to shut down.*

##### DR-REQ-344077/A-FMEM - EVSE Status Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - EVSE Status Signal** | **ID**  DR-REQ-344077 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission FHEV [MHT\_FHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the EVSE Status (ChrgrInPwMde\_D\_Actl) is missing, the BECM will treat the signal as "EVSE Not Detected" (ChrgrInPwMde\_D\_Actl = 0x0).

*Rationale/Notes*

*The BECM should treat a missing EVSE status signal as “EVSE Not Detected” in order to avoid a loop that will cause the BECM to cycle between Not Ready and Charge Wait and issue wakeups indefinitely.*

##### DR-REQ-346401/A-FMEM - On Board Fault

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - On Board Fault** | **ID**  DR-REQ-346401 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM will set an internal On Board Charging Fault if any of the following system conditions are true:

1. The BECM Charge Status is “Faulted” (BattChrgRdyStat\_D\_Actl = 0x5)

OR

1. The BCCM Charge Status is “Charger Fault” (ChrgrRdyStat\_D\_Actl = 0x2)

OR

1. The DCGM Charge Status is “Faulty” (DcChrgRdy\_D\_Stat = 0xF)

*Rationale/Notes*

*The internal On Board Charging Fault state is used to drive the CSI Display.*

##### DR-REQ-347824/A-FMEM - BECM Timeout

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - BECM Timeout** | **ID**  DR-REQ-347824 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the BECM Charge Status is “Charge Ready”, “Charge Wait”, or “Charge Complete” for more than 35 seconds (calibratable), it will transition to “Not Ready” and set the BECM Charge Sustain to 0.

*Rationale/Notes*

*System conditions may cause the BCCM to remain in a “Not Ready” state when the BECM is in Charge Wait (e.g. the vehicle is not in park). In these cases, the BECM must be able to abort the charge sequence and shut down in order to prevent draining the 12V battery.*

##### DR-REQ-355178/A-FMEM - Charge Target Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Charge Target Signal** | **ID**  DR-REQ-355178 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Charge Target signal (CurntTrgtSoc\_Pc\_Rq) is missing and the HEV Wake line is high, the charger will treat the signal as 100%

If the Charge Target signal (CurntTrgtSoc\_Pc\_Rq) is missing and the HEV Wake line is low, the charger will treat the signal as the last assumed value.

*Rationale/Notes*

*The Charge Target signal drives when the BECM is supposed to send a wakeup to the powertrain so that the PEPC system can inhibit charging based on the customer’s charge target selection.*

*Since the powertrain module may be asleep during charging, the BECM must assume a normal missing signal as the last known value. However, if HEV Wake is high (i.e. the powertrain module is expected to be awake) and the signal is missing, the BECM should default to the maximum value of 100%.*

*See DR-REQ-xxxx in the PEPC HLF for details.*

### DR-REQ-140445/B-Continue Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **Continue Charging** | **ID**  DR-REQ-140445 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Continue Charging**

The BCCM shall continue charging if the following system conditions are true:

1. The BCCM Charger Ready Status is “Charger Ready” or “Charging” (ChrgrRdyStat\_D\_Actl = 0x1, 0x3)

AND

1. The BECM Battery Charge Ready Status is ‘Charging’ (BattChrgRdyStat\_D\_Actl = 0x3)

AND

1. The HPCM Charge Inhibit Request is NOT “Inhibit Charging” (BattChrgInhbt\_D\_Rq != 0x1)

*Note: While charging, the vehicle will not be able to shift out of Park, and will not be able to move to a torque available mode, so these system inputs are disregarded here.*

### DR-REQ-140446/B-End Plug-in Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **End Plug-in Charging** | **ID**  DR-REQ-140446 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**End Plug-in Charging**

Plug-in Charging shall be disabled if any of the following system conditions are true:

1. The BCCM Charger Status is NOT ‘Ready’ or “Charging” (ChrgrRdyStat\_D\_Actl != 0x1 or 0x3)

OR

1. The BECM Battery Charge Ready Status is NOT ‘Charging’ OR ‘Battery Charge Ready’ (BattChrgRdyStat\_D\_Actl != 0x2 or 0x3)

OR

1. The HPCM Charge Inhibit Request is “Charge Inhibit” (BattChrgInhbt\_D\_Rq = 0x1)

*Note: The HPCM may send Charge Inhibit if the vehicle has charge programming enabled and the low cost charge window has ended. See PEPC HLF for full set of requirements for charge programming.*

#### DR-REQ-358756/A-BECM Charge Complete Declaration

|  |  |  |
| --- | --- | --- |
| **Title**  **BECM Charge Complete Declaration** | **ID**  DR-REQ-358756 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

When the BECM Charge Status transitions to “Charge Complete”, it shall remain in that state for at least 2 seconds (calibratable).

*Rationale/Notes*

*Other modules rely on the declaration of Charge Complete to perform their function. In order to give these modules time to wake up and perform their action, the BECM must hold the Charge Complete state for at least two seconds.*

### DR-REQ-140526/A-End Inductive Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **End Inductive Charging** | **ID**  DR-REQ-140526 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**End Inductive Charging**

Inductive Charging shall be disabled if any of the following conditions are true:

1. The BCCM Charger Status is NOT ‘Ready’ or “Charging” (ChrgrRdyStat\_D\_Actl != 0x1 or 0x3)

OR

1. The BECM Battery Charge Ready Status is NOT ‘Charging’ OR ‘Battery Charge Ready’ (BattChrgRdyStat\_D\_Actl != 0x2 or 0x3)

OR

1. The BECM has declared “Charge Complete” (BattChrgRdyStat\_D\_Actl = 0x4)

OR

1. The HPCM Charge Inhibit Request is “Charge Inhibit” (BattChrgInhbt\_D\_Rq = 0x1)

OR

1. The HPCM Power Pack Torque Status changes to a torque producing mode (PwPckTq\_D\_Stat = 0x03)

*Note 1: The HPCM shall send Charge Inhibit if the vehicle has charge programming enabled and the low cost charge window has ended.*

*Note 2: BCCM will no longer be ready if the ICCM is faulted.*

### DR-REQ-140541/A-BCCM Contactor Power Assertion

|  |  |  |
| --- | --- | --- |
| **Title**  **BCCM Contactor Power Assertion** | **ID**  DR-REQ-140541 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**BCCM Contactor Power Assertion**

The BCCM shall transition Contactor Power Relay to ‘Enable (ChrgrCnnctPwr\_B\_Stat = 0x1) under the following conditions:

1. BECM Charge Ready Status is “Battery Charge Wait”, “Battery Charge Ready” or “Charging” (BattChrgRdyStat\_D\_Actl = 0x1, 0x2, 0x3)

AND

1. The vehicle is in Park (GearLvrPos\_D\_Actl = 0x0)

OR

The vehicle is in Neutral (GearLvrPos\_D\_Actl = 0x2) AND the vehicle is Factory Mode (LifeCycMde\_D\_Actl = 0x1).

AND

1. The vehicle is not in a torque producing mode (PwPckTq\_D\_Stat != 0x3)

AND

1. The charge cord is locked (ChrgCordLck\_D\_Stat = 0x2) (EU vehicles only)

*Rationale/Notes*

*The charger needs to enable the CPE during charging, or when the 12V batter requires support.*

### DR-REQ-140542/C-BCCM Contactor Power De-Assertion

|  |  |  |
| --- | --- | --- |
| **Title**  **BCCM Contactor Power De-Assertion** | **ID**  DR-REQ-140542 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**BCCM Contactor Power De-Assertion**

The BCCM shall de-assert contactor power relay under the following conditions:

1. BECM CAN sustain is de-asserted (BattTracChrgSustn\_B\_Rq = 0x0) AND HEV wake is low

OR

1. The Main contactors are closed (BattTracCnnct\_D\_Cmd = 0x1) AND the vehicle is off plug (PlgActv\_D\_ActlChrgr = 0x0)

OR­­­­

1. The Charger Input Power Mode is “Digital Comm Detected” (ChrgrInPwMde\_D\_Actl = 0x2)

AND

The Digital Gateway mode is “AcEim” or “AcPnC/Eim “(DgtlCommGtwyMde\_D\_Stat = 0x4 or 0x6)

AND

The (off Board) DC Charge Ready Status is “Initialization” (DcChrgRdy\_D\_Stat = 0x1)

AND

The Battery Charge Status is “Charge Wait” (BattChrgRdyStat\_D\_Actl = 0x1)

OR

1. The BCCM determines it must disable CPE per the HLVEM ENS requirements (DR-REQ-311150)

*Note: Cannot use “Not Ready” as the BECM may go to not ready before opening contactors, such as when charging is inhibited by the HPCM. The charge sustain is the best way to determine if the vehicle is going to charge.*

*For the use case of Charge 🡪 Run, the BCCM will not de-assert CPE due to HEV being high. Additional logic is required for the BCCM to de-assert once off plug.*

*The CPE must be disabled momentarily in digital communication sequences where BCB toggle is being triggered.*

### DR-REQ-140543/A-BCCM Contactor Power Diagnostics

|  |  |  |
| --- | --- | --- |
| **Title**  **BCCM Contactor Power Diagnostics** | **ID**  DR-REQ-140543 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**BCCM Contactor Power Diagnostics**

Prior to transitioning the contactor power relay from de-asserted to asserted the BCCM shall perform Open and Short Circuit detection. If either condition is detected, a DTC shall be set. If an open circuit is detected, contactor power shall not be asserted until the next charge cycle with no open circuit detected.

### DR-REQ-140546/B-Contactor Power- Invalid Contactor Command from BECM

|  |  |  |
| --- | --- | --- |
| **Title**  **Contactor Power- Invalid Contactor Command from BECM** | **ID**  DR-REQ-140546 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the vehicle is off plug, the BCCM shall de-assert the contactor power relay a calibratable time after receiving an invalid or missing value of BattTracCnnct\_D\_Cmd

*Note:*

*Effectively the BCCM can treat a missing or invalid value of this signal as “closed”. If on plug the BCCM should continue to assert CPE, but if off plug it pull CPE and shut down per the end charging requirements.*

### DR-REQ-221352/A-Conductive Charging Preferred

|  |  |  |
| --- | --- | --- |
| **Title**  **Conductive Charging Preferred** | **ID**  DR-REQ-221352 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If both conductive (AC or DC) and inductive charging is available, the BCCM shall always choose to charge conductively, and will follow all restraints and requirements necessary for conductive charging.

*Rationale/Notes*

*Conductive charging is less flexible than inductive charging. In order to ensure safety and hardware protection, conductive charging and it’s requirements/restraints should always supersede inductive charging.*

### DR-REQ-193867/D-BECM Event Wakeups

|  |  |  |
| --- | --- | --- |
| **Title**  **BECM Event Wakeups** | **ID**  DR-REQ-193867 | **Revision**  D  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links**  DR-REQ-261943/B-Charge Target Reached Event Wakeup[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CQcx6XIzx3NrTD)]  DR-REQ-262123/D-Charge Requested CAN Sustain[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=jIV91TkWx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall assert the HEV\_Wakeup hardline under any of the following conditions:

1. Any transition between any battery heating or cooling mode

OR

DCDC OR BCCM require max cooling (HPCM will ignore on non e-RAD vehicles) (*BattTracTeEvnt\_B\_Stat is sent as TRUE*).

1. When the charge target is reached. If no target is set, charge complete shall be used (*BattChrgTrgtEvnt\_B\_Stat is sent as TRUE*).
2. ~~Initiating Active Cabin Venting~~

*Note:*

1. *See battery thermal HLF for conditions. Decided to include transitions into cooling mode 0 (off) for simplicity and to allow the HPCM to set a required proportional valve state.*

#### DR-REQ-261943/B-Charge Target Reached Event Wakeup

|  |  |  |
| --- | --- | --- |
| **Title**  **Charge Target Reached Event Wakeup** | **ID**  DR-REQ-261943 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-193867/D-BECM Event Wakeups[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ipVtROnMx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall drive the HEV\_Wake hardline high and send the Charge Target Reached Event Wakeup CAN Signal (*BattChrgTrgtEvnt\_B\_Stat*) as TRUE:

* When the customer SoC has reached or exceeded the target SoC (BattTracSoc\_Pc\_Dsply = BattChrgTrgtSoC\_D\_Rq OR BattTracSoc\_Pc\_Dsply = CurntTrgtSoc\_Pc\_Rq)

OR

* The BECM has transitioned to “Charge Complete” (BattChrgRdyStat\_D\_Actl = 0x4)

*Note: Charge Complete means you have reached 100%. Charge Target can be less than 100%*

*CurntTrgtSoc\_Pc\_Actl will begin being used with MY21 CX727.*

#### DR-REQ-262123/D-Charge Requested CAN Sustain

|  |  |  |
| --- | --- | --- |
| **Title**  **Charge Requested CAN Sustain** | **ID**  DR-REQ-262123 | **Revision**  D  **Status** |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-193867/D-BECM Event Wakeups[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ipVtROnMx3NrTD)]  DR-REQ-193374/B-BECM CAN Sustain Conditions[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=hrWdtm3Yx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall issue the Charge Requested CAN Sustain Wakeup, BattTracChrgSustn\_B\_Rq = 0x1 Active when the following conditions are met:

1. BattChrgInhbt\_D2\_Rq = 0x0: Enable Charging OR 0x3 MaintainTargetSoc OR 0x2 EndAtTarget

AND

1. ChrgrInPwMde\_D\_Actl= 0x2: DigitalCommDetected OR 0x3: AC Basic OR 0x4: AC Digital OR 0x5: DC Charging OR 0x6 IC Charging

AND

1. Either
   1. Battery needs charging (SOC <98% calibratable)

OR

* 1. The low voltage support is required (ULoSrcOnPlg\_B\_Cmd = 0x1)

OR

* 1. The contactors are requested closed (BattTracCnnct\_D\_Rq = 0x1) AND the contactors are closed (BattTracCnnct\_D\_Cmd = 0x1)

AND

1. ChrgrRdyStat\_D\_Actl = 0x0: Not Ready OR 0x1: Charge Ready OR 0x3: Charging.

AND

1. The HEV Wake is set to HIGH

The sustain shall be issued to the following modules:

* BCM
* PCM
* DCDC
* BCCM
* BCMC (CAN PDB)

The BECM shall drop the Charge Requested CAN Sustain Wakeup (BattTracChrgSustn\_B\_Rq = 0x0) when it is in the “Not Ready” or “Faulted” State (BattChrgRdyStat\_D\_Actl = 0x0 or 0x5) and it has completed all contactor logic related to charging.

*Notes:*

*Charge Permitted’ is a replacement for Charge Inhibit, to prevent cycling of contactors during value charging.*

*Charge Requested not only serves to sustain modules for charging, but an indication to the HPCM that the BECM recognized its request for charge.*

*HEV wake is required to set the CAN sustain, but it is not required to hold the CAN sustain. This will help avoid a loop where the sustain is always sent even if other components (like the BCCM) are not ready to charge, but the BECM can recover and send the sustain again and attempt to start charging if the HEV wake is HIGH again.*

*The BECM needs to hold the CAN sustain for as long as it needs other modules to perform functions related to charging or completing charging. Since the BCCM sends the CPE to allow the contactors to be cycled, the BECM needs to keep the BCCM awake after completing charging in order to perform a weld check (if needed).*

#### DR-REQ-314690/C-DC Charge Requested CAN Sustain

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Charge Requested CAN Sustain** | **ID**  DR-REQ-314690 | **Revision**  C  **Status** |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall issue the DC Charge Requested CAN Sustain Wakeup, BattTracDcChrgSustn\_B\_Rq = 0x1 Active when the following conditions are met:

1. BattChrgInhbt\_D2\_Rq = 0x0: Enable Charging OR 0x3 MaintainTargetSoc OR 0x2 EndAtTarget

AND

1. ChrgrInPwMde\_D\_Actl= 0x2: DigitalCommDetected OR 0x5: DC Charging

AND

1. Battery needs charging (SOC <98% calibratable)

AND

1. ChrgrRdyStat\_D\_Actl = 0x0: Not Ready OR 0x1: Charge Ready OR 0x3: Charging.

AND

1. The HEV Wake is set to HIGH

The sustain shall be issued to the following modules:

* HPCM

The BECM shall drop the DC Charge Requested CAN Sustain Wakeup (BattTracDcChrgSustn\_B\_Rq = 0x1) when it has entered the “Not Ready” or “Faulty” state (BattChrgRdyStat\_D\_Actl = 0x0 or 0x5) and it has completed all contactor logic related to DC charging.

*Notes:*

*DC Charging requires the HPCM to be awake in order to send the contactor close request. Since HPCM is not awake during normal charging, it cannot use the AC Charging Sustain (BattTracChrgSustn\_B\_Rq) and so a new, DC Charging specific sustain is required.*

*Charge Permitted’ is a replacement for Charge Inhibit, to prevent cycling of contactors during value charging.*

*Charge Requested not only serves to sustain modules for charging, but an indication to the HPCM that the BECM recognized its request for charge.*

*HEV wake is required to set the CAN sustain, but it is not required to hold the CAN sustain. This will help avoid a loop where the sustain is always sent even if other components (like the BCCM) are not ready to charge, but the BECM can recover and send the sustain again and attempt to start charging if the HEV wake is HIGH again.*

*The BECM needs to hold the CAN sustain for as long as it needs other modules to perform functions related to charging or completing charging. Since the BCCM sends the CPE to allow the contactors to be cycled, the BECM needs to keep the BCCM awake after completing charging in order to perform a weld check (if needed).*

### DR-REQ-358740/B-Disable Charging for OTA flashing

|  |  |  |
| --- | --- | --- |
| **Title**  **Disable Charging for OTA flashing** | **ID**  DR-REQ-358740 | **Revision**  B  **Status** |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

When the OTA System is flashing a module on the vehicle, the HPCM shall prevent charging using the Charge Inhibit request (BattChrgInhbt\_D\_Rq = 0x1).

If the HPCM itself is the module being flashed, the HPCM shall prevent charging using the Charge Inhibit request (BattChrgInhbt\_D\_Rq = 0x1) before initiating the flash process.

*Rationale/Notes*

*OTA status is driven by OtaActv\_D\_Stat. Currently, the HPCM should disable charging for any non-interruptible OTA.*

## SR-REQ-137814/A-12V Battery Support On Plug

|  |  |  |
| --- | --- | --- |
| **Title**  **12V Battery Support On Plug** | **ID**  SR-REQ-137814 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  003400\_HEV - Electrified Powertrain System | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links**  DR-REQ-213756/B-LV Energy Transfer on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=C5VpXolKx3NrTD)] | |
| **Verified By Test Method(s)**  TST-REQ-266358/B-12V Battery Support on Plug | | |

**Description**

**12V Battery Support On Plug**

The 12V battery shall be maintained if the vehicle is on plug and wall power is present.

*Rationale/Notes: Importantly, the system should not stop charging if the DCDC converter fails.*

### DR-REQ-213756/B-LV Energy Transfer on Charge

|  |  |  |
| --- | --- | --- |
| **Title**  **LV Energy Transfer on Charge** | **ID**  DR-REQ-213756 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 2\_Starting Electrical Accessory PT Functions | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137814/A-12V Battery Support On Plug[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=BraVw6x1x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The HPCM/PCM shall support the 12V battery while on plug per the LVSM HLF (298474 – HLFR\_LVSP)

***Rationale/Notes***

*The PCM/HPCM is responsible for requesting the activation of the DCDC converter. The 12V battery does need to be maintained while on plug, but the details are all covered in the Low Voltage Setpoint Maintenance HLF.*

## SR-REQ-137813/C-Detection of Plug Events

|  |  |  |
| --- | --- | --- |
| **Title**  **Detection of Plug Events** | **ID**  SR-REQ-137813 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  003400\_HEV - Electrified Powertrain System | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links**  DR-REQ-235507/B-Raw Plug Status Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SwfxnjMXx3NrTD)]  DR-REQ-137808/C-Types of Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i8QxmyXVx3NrTD)]  DR-REQ-193866/C-BCCM Event Wakeups[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=BqYd9u55x3NrTD)] | |
| **Verified By Test Method(s)**  TST-REQ-266359/B-Detection of Plug Events | | |

**Description**

**Detection of Plug Events**

The Plug in Charging System shall detect when an active EVSE changes plug states (Plugged or unplugged) and issue a powertrain wakeup.

*Rationale/Notes*

*Other powertrain components react to changes in plug state. The BCCM is responsible for detecting changes in plug state and alerting the other powertrain components via PT wakeup.*

### DR-REQ-235507/B-Raw Plug Status Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **Raw Plug Status Signal** | **ID**  DR-REQ-235507 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137813/C-Detection of Plug Events[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=C7X1lqrFx3NrTD)] | **Down-Links**  DR-REQ-140555/A-Plug Status Fault Detection[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=RbVVRD6_x3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**Raw Plug Status Signal**

The BCCM shall determine the plug status of the vehicle and transmit it over CAN.

Signal Definition

Signal Name: PlgActv\_D\_ActlChrgr

Size: 2 bits

Values:

* 0x0 – Off Plug (Disconnected)
* 0x1 – On Plug (Connected)
* 0x2 – Not Used
* 0x3 – Faulty

Resolution: Discrete

Rate: 100 msec

Tx: BCCM

Rx: TCU, PCM, DCGM, BECM, HPCM

*Rationale/Notes*

*See BCCM IFS for details on determining plug status based on the cordset standard in each market (e.g. Prox and Pilot)*

#### DR-REQ-140555/A-Plug Status Fault Detection

|  |  |  |
| --- | --- | --- |
| **Title**  **Plug Status Fault Detection** | **ID**  DR-REQ-140555 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-235507/B-Raw Plug Status Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SwfxnjMXx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Plug Status Fault Detection**

The BCCM shall determine a faulted plug status per the Fault Tree Matrix below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **C344PHEV Charger Fault Tree Matrix** | |  |  |  |  |
|  |  |  |  |  |  |
| **INPUTS** | |  |  | **OUTPUTS** | |
| **Proximity Voltage** | **Pilot Vmax** | **# of  Faults** |  | **Charger Action** | **Plug Status** |
| NOTE: |  |  |  |  |  |
| Grey shaded INPUTS are "faulted" inputs | |  |  |  | PROXIMITY |
| White shaded INPUTS are normal inputs | |  |  |  | PILOT (Bad PROX) |
| Grey shaded OUTPUTS are ON\_PLUG (observable) | |  |  |  |  |
| Light Blue shaded OUTPUTS need OFF\_PLUG (observable) | |  |  |  |  |
| Pink shaded OUTPUTS need RESOLUTION (no observability / system choice) | |  |  |  |  |
| Dark Grey shaded CHARGER STATE are Not Design Intent | |  |  |  |  |
|  |  |  |  |  |  |
| Q: How does Charger measure -12V with the diode in the Pilot? A: If the charger measures -12V at the Pilot, then the diode is shorted (Charger Fault). | | |  |  |  |
| Q: What does the Charger do when there is a valid Pilot but No Proximity? A: The Charger will NOT charge. The Plug Status is ON-PLUG. | | |  |  |  |
| Q: How does the Proximity Voltage measure +5V ? A: The R5 resistor is OPEN in the Charger. | | |  |  |  |
|  |  |  |  |  |  |
| 5V (Short Circuit to 5V Fault) | 12V (R3 Open Fault) | 2 |  | **Do NOT Charge  Severity for Vehicle: PHEV = 7, BEV = 8** | ON\_PLUG |
| 5V (Short Circuit to 5V Fault) | 9V (Connected / Not Ready ) | 1 |  | ON\_PLUG |
| 5V (Short Circuit to 5V Fault) | 6V (Connected / Ready / No Ventilation) | 1 |  | ON\_PLUG |
| 5V (Short Circuit to 5V Fault) | 3V (Connected / Ready / Ventilation (Charger Fault)) | 2 |  | ON\_PLUG |
| 5V (Short Circuit to 5V Fault) | 0V (EVSE Disconnected) | 1 |  | FAULTY |
| 5V (Short Circuit to 5V Fault) | -12V (Fault) - DIODE SHORTED | 2 |  | ON\_PLUG |
| 4.56V (OFF\_PLUG) | 12V (R3 Open Fault) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 4.56V (OFF\_PLUG) | 9V (Connected / Not Ready ) |  |  | **Prepare for Charge** | ON\_PLUG |
| 4.56V (OFF\_PLUG) | 6V (Connected / Ready / No Ventilation) |  |  | **Ready to CHARGE** | ON\_PLUG |
| 4.56V (OFF\_PLUG) | 3V (Connected / Ready / Ventilation (Charger Fault)) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 4.56V (OFF\_PLUG) | 0V (EVSE Disconnected) |  |  | **Do NOT Charge** | OFF\_PLUG |
| 4.56V (OFF\_PLUG) | -12V (Fault) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 2.76V (ON\_PLUG\_S3\_OPEN) | 12V (R3 Open Fault) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 2.76V (ON\_PLUG\_S3\_OPEN) | 9V (Connected / Not Ready ) |  |  | **Prepare for Charge** | ON\_PLUG |
| 2.76V (ON\_PLUG\_S3\_OPEN) | 6V (Connected / Ready / No Ventilation) |  |  | **Ready to CHARGE** | ON\_PLUG |
| 2.76V (ON\_PLUG\_S3\_OPEN) | 3V (Connected / Ready / Ventilation (Charger Fault)) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 2.76V (ON\_PLUG\_S3\_OPEN) | 0V (EVSE Disconnected) |  |  | **Do NOT Charge** | ON\_PLUG |
| 2.76V (ON\_PLUG\_S3\_OPEN) | -12V (Fault) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 1.51V (ON\_PLUG\_S3\_CLOSED) | 12V (R3 Open Fault) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 1.51V (ON\_PLUG\_S3\_CLOSED) | 9V (Connected / Not Ready ) |  |  | **Prepare for Charge** | ON\_PLUG |
| 1.51V (ON\_PLUG\_S3\_CLOSED) | 6V (Connected / Ready / No Ventilation) |  |  | **Ready to CHARGE** | ON\_PLUG |
| 1.51V (ON\_PLUG\_S3\_CLOSED) | 3V (Connected / Ready / Ventilation (Charger Fault)) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 1.51V (ON\_PLUG\_S3\_CLOSED) | 0V (EVSE Disconnected) |  |  | **Do NOT Charge** | ON\_PLUG |
| 1.51V (ON\_PLUG\_S3\_CLOSED) | -12V (Fault) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 0V (Short Circuit to GND Fault) | 12V (R3 Open Fault) | 2 |  | **Do NOT Charge  Severity for Vehicle: PHEV = 7, BEV = 8** | ON\_PLUG |
| 0V (Short Circuit to GND Fault) | 9V (Connected / Not Ready ) | 1 |  | ON\_PLUG |
| 0V (Short Circuit to GND Fault) | 6V (Connected / Ready / No Ventilation) | 1 |  | ON\_PLUG |
| 0V (Short Circuit to GND Fault) | 3V (Connected / Ready / Ventilation (Charger Fault)) | 2 |  | ON\_PLUG |
| 0V (Short Circuit to GND Fault) | 0V (EVSE Disconnected) | 1 |  | FAULTY |
| 0V (Short Circuit to GND Fault) | -12V (Fault) | 2 |  | ON\_PLUG |

Note: The fault tree matrix is from Chris Ochocinski.

*Rationale/Notes:*

### DR-REQ-137808/C-Types of Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **Types of Charging** | **ID**  DR-REQ-137808 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137813/C-Detection of Plug Events[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=C7X1lqrFx3NrTD)] | **Down-Links**  DR-REQ-271049/B-EVSE Faulty - Cluster Notification[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TZcpvsgqx3NrTD)]  DR-REQ-271048/B-EVSE Not Compatible - Cluster Notification[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SCdpPxu7x3NrTD)]  DR-REQ-271039/A-EVSE Not Compatible[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ziVlV$nxx3NrTD)]  DR-REQ-271040/A-EVSE Faulty[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TbclV$nxx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall determine if the vehicle is actively connected to an off-board charging device and communicate the Charger Input Power Mode over CAN.

*Note: All plug-in vehicles shall have an AC charging inlet port. Some vehicle shall be equipped with an additional HV DC charging inlet port or an Inductive Charge Coil.*

Signal Definition

Signal Name: ChrgrInPwMde\_D\_Actl

Size: 4 bits

Values:

* 0x0 – EVSE Not Detected
* 0x1 – EVSE Paused
* 0x2 – Digital Comm Detected
* 0x3 – AC Basic
* 0x4 – AC Digital
* 0x5 – DC Charging
* 0x6 – Inductive Charging
* 0x7 – EvseNotCompatible
* 0x8 – EvseFaulty
* 0x9 – DigitalCommEnd
* 0xA – Not used
* 0xB – Not used
* 0xC – Not used
* 0xD – Not used
* 0xE – Not used
* 0xF – Not used

Resolution: Discrete

Rate: 100 msec

Tx: BCCM

Rx: TCU, BECM, HPCM, IPC, DCGM

*Rationale/Notes*

*Below is a definition of the states of ChrgrInPwMde\_D\_Actl:*

* *EVSE Not Detected – The default state, this indicates there is not EVSE detected at the charge port. It can also represent a dead EVSE (cable with no external power). Note that the prox is still capable of setting the plug status even if there is no EVSE detected*
* *EVSE Paused – the EVSE is connected, but is not transferring power (Pilot Duty Cycle = 100%). Usually this is because the EVSE has been manually paused, or is automatically paused and waiting for a payment from the customer.*
* *AC Basic – the attached EVSE is a basic Level 1 or Level 2 AC charger. “Basic” in this term means that the EVSE power is transmitted via the analog Pilot signal (Pilot Duty Cycle between 10% and 95%)*
* *AC Digital – the attached EVSE is a Level 1 or Level 2 AC Charger that uses Digital Communication to transmit the EVSE power, instead of the analog Pilot signal (Pilot Duty Cycle = 5%)*
  + *As of Gen 4, PHEV vehicles are incapable of charging with an AC Digital EVSE. In this case, ChrgrInPwMde will switch to EVSE Not Compatible.*
  + *AC Digital EVSEs are currently very rare, and are capable of switching to AC Basic charging by calling the EVSE manufacturer.*
* *DC Charging – the attached EVSE is a DC Fast Charger*
* *Inductive Charging – the vehicle is currently charging via an inductive charger.*
* *EVSE Not Compatible – The attached EVSE is not capable of charging the vehicle.*
  + *This is most likely because an AC Digital charger is attached to a vehicle incapable of digital communitcation.*
  + *Additional HMI for incompatible EVSEs is described in DR-REQ-271048*
* *EVSE Faulty – The charging system has determined that there is a fault on the EVSE and Charging may be disabled as a result*
  + *Additional HMI for Faulty EVSEs is described in DR-REQ-XXXX*

#### DR-REQ-271039/A-EVSE Not Compatible

|  |  |  |
| --- | --- | --- |
| **Title**  **EVSE Not Compatible** | **ID**  DR-REQ-271039 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-137808/C-Types of Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i8QxmyXVx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM will set the Charger Input Power Mode to “EVSE Not Compatible” (ChrgrInPwMde\_D\_Actl = 0x7) if the Pilot Duty Cycle is 5% and the vehicle is incapable of communicating over a digital interface.

*Rationale/Notes*

*Some Level 2 chargers exist that communicate using a digital system instead of the Pilot Duty Cycle. PHEVs currently do not have a DCGM and are thus incapable of charging with this protocol. The vehicle should attempt to alert the customer so the customer may contact the EVSE manufacturer.*

#### DR-REQ-271040/A-EVSE Faulty

|  |  |  |
| --- | --- | --- |
| **Title**  **EVSE Faulty** | **ID**  DR-REQ-271040 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-137808/C-Types of Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i8QxmyXVx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The charger will set the Charger Input Power Mode to “EVSE Faulty” (ChrgrInPwMde\_D\_Actl = 0x8) if it determines there is a fault on the external charger. Any time the charger sets “EVSE Faulty” there should be an associated DTC.

*Rationale/Notes*

*The use cases to determine an external charger fault are complex and should be defined at the subsystem or feature level.*

### DR-REQ-193866/C-BCCM Event Wakeups

|  |  |  |
| --- | --- | --- |
| **Title**  **BCCM Event Wakeups** | **ID**  DR-REQ-193866 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137813/C-Detection of Plug Events[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=C7X1lqrFx3NrTD)] | **Down-Links**  DR-REQ-261820/B-Charger Power Available Change Wake Event[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=yuQtpdHJx3NrTD)]  DR-REQ-261819/D-Charging Status Change Wake Event[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=D$d1rpHkx3NrTD)]  DR-REQ-261818/A-Plug Status Event Wakeup[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=Dxahf5okx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall assert the HEV\_Wake hardline and set the appropriate Event Wakeup CAN signal as TRUE for the following events:

* Plug Status Event
* Charging status Change Event
* Charger Power Available Change Event

#### DR-REQ-261818/A-Plug Status Event Wakeup

|  |  |  |
| --- | --- | --- |
| **Title**  **Plug Status Event Wakeup** | **ID**  DR-REQ-261818 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-193866/C-BCCM Event Wakeups[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=BqYd9u55x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall drive the HEV\_Wake hardline high and send Plug Status Event Wakeup CAN signal (*PlgStatEvnt\_B\_Stat*) as TRUE if:

1. The PILOT changes from 0% to any nonzero value (Plug in event detected)

OR

1. The PILOT changes from any nonzero value to 0% (Unplug event detected)

OR

1. Any change in PROX is detected (plug or unplug event detected)

*Notes:*

*No Wakeup on transition from off plug to on plug due to DC fast charging or digital comm AC charging. Delays in the digital comm process make this wakeup unnecessary.*

#### DR-REQ-261819/D-Charging Status Change Wake Event

|  |  |  |
| --- | --- | --- |
| **Title**  **Charging Status Change Wake Event** | **ID**  DR-REQ-261819 | **Revision**  D  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-193866/C-BCCM Event Wakeups[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=BqYd9u55x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall drive the HEV\_Wake hardline high and send the Charging Status Change Event Wakeup CAN Signal (*ChrgChngEvnt\_B\_Stat*) as TRUE upon:

1. Charger charge status (ChrgrRdyStat\_D\_Actl) has any change of state

OR

1. Transitions from DCGM status from ‘initialization’ to ready’

OR

1. When BCCM needs to send Charge Change Request to HPCM

OR

1. The Charge Cord Unlock Button has been pushed

OR

1. The BCCM must re-lock the charge cord per the Cord Re-lock strategy for EU (DR-REQ-271509)

*Notes:*

*In order to unlock the charge cord in certain use cases, the BCCM needs voltage on the bus to drop below a threshold. This voltage is reported by the BECM. As such, the BCCM must ensure the BECM is awake when a cord unlock request is received.*

#### DR-REQ-261820/B-Charger Power Available Change Wake Event

|  |  |  |
| --- | --- | --- |
| **Title**  **Charger Power Available Change Wake Event** | **ID**  DR-REQ-261820 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-193866/C-BCCM Event Wakeups[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=BqYd9u55x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall drive the HEV\_Wake hardline high and send the Charger Power Available Change Event Wakeup CAN Signal (*ChrgrAvailEvnt\_B\_Stat*) as TRUE when:

1. The Input power available (ChrgrIn\_Pw\_Mx) changes by more than a calibratable amount (100W default)

OR

1. The Pilot signal changes by more than a calibratable amount (5% default)

OR

1. ChrgrInPwMde\_D\_Actl has any transition of state.

*Notes:*

*The power available change will capture transitions into and out of the EVSE pause modes. Using ChrgrInPwMde\_D\_Actl will cover cases where duty cycle of Pilot doesn’t meet the calibratable change in power for state transitions like Digital Comm Detected to EVSE Not Compatible, needing to communicate EVSE Faulty to the Cluster & TCU, etc.*

### DR-REQ-309265/A-External Charge Fault Display

|  |  |  |
| --- | --- | --- |
| **Title**  **External Charge Fault Display** | **ID**  DR-REQ-309265 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Charger Input Power Mode is “EVSE Faulty” (ChrgrInPwMde\_D\_Actl = 0x8), the VSC shall set the External Charger Fault Display Signal to “Yes” (ExtChrgrFalt\_B\_Dsply = 0x1) until:

1. The vehicle key state changes from “On” to “Off”.

OR

1. The arbitrated plug status (PlgActvArb\_B\_Actl) changes from OFF PLUG (0x0) to ON PLUG (0x1)

Signal Definition

Signal Name: ExtChrgrFalt\_B\_Dsply

Size: 1 bit

Values:

* 0x0 – No
* 0x1 – Yes

Resolution: Discrete

Rate: 1000 msec

Tx: HPCM

Rx: IPC

*Notes/Rationale:*

*Normally, ChrgStat\_D2\_Dsply would be set to EVSE Fault. However, ChrgStat\_D2\_Dsply cannot latch the Faulty state if the vehicle is unplugged – thus, the customer would not get the pop up saying their EVSE was faulted, and it may result in TGW’s incorrectly assigned to the charging system as the vehicle did not charge.*

*The cluster will instead display the popup based on ExtChrgrFalt\_B\_Dsply. A separate signal allows the HPCM to latch the faulty value until the next key off, so the customer can see their popup without any change to ChrgStat\_D2\_Dsply. ChrgStatD2\_Dsply will still be used to communicate EVSE Fault status to the APIM and TCU. As such, the status of the external charge fault needs to be stored in KAM until the vehicle keys on then keys off again.*

*If, however, the plug status changes from OFF PLUG to ON PLUG, the BCCM will re-evaluate the EVSE status. It is possible that a new, non faulted EVSE is plugged in, and the HPCM should clear the fault flag and wait for a new ChrgrInPwMde\_D\_Actl from the BCCM.*

#### DR-REQ-271049/B-EVSE Faulty - Cluster Notification

|  |  |  |
| --- | --- | --- |
| **Title**  **EVSE Faulty - Cluster Notification** | **ID**  DR-REQ-271049 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-137808/C-Types of Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i8QxmyXVx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

When the External Charge Fault Display signal is “Yes” (ExtChrgrFalt\_B\_Dsply = 0x1), and the vehicle is keyed on into Accessory or Run mode, the cluster shall display a popup notification to the cluster indicating that there was an external charge station fault.

*Rationale/Notes*

*The cluster serves as a way of notifying the customer of a faulted EVSE, but the customer must turn the vehicle on to see it.*

*The CSI will also display a unique External Fault LED pattern to give the customer an initial indication of the problem. See CSI HLF for details.*

### DR-REQ-271048/B-EVSE Not Compatible - Cluster Notification

|  |  |  |
| --- | --- | --- |
| **Title**  **EVSE Not Compatible - Cluster Notification** | **ID**  DR-REQ-271048 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-137808/C-Types of Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i8QxmyXVx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

When the Charger Status Display signal is “EVSE Not Compatible” (ChrgStat\_D2\_Dsply = 0x3), and the vehicle is keyed on into Accessory or Run mode, the cluster shall display a popup notification to the cluster indicating that the current EVSE is not capable of charging the vehicle.

*Rationale/Notes*

*The cluster serves as a way of notifying the customer of an incompatible EVSE, but the customer must turn the vehicle on to see it.*

### DR-REQ-361978/A-Multiple Charge Ports - DC Priority

|  |  |  |
| --- | --- | --- |
| **Title**  **Multiple Charge Ports - DC Priority** | **ID**  DR-REQ-361978 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the vehicle is plugged in to both an AC and a DC charge port, the BCCM shall behave in accordance with all DC or AC Digital charging requirements.

The BCCM can still perform diagnostics on the AC Charge port, but all system outputs should reflect the DC charge port, including:

* Plug Status
* Charge Status
* Faults (External and Internal)
* Cord Lock status

*Rationale/Notes*

*This only applies to programs that have separate DC and AC charge ports, such as China BEVs.*

*Effectively, the AC Charge port can never influence the vehicle if the DC Charge port is also plugged in.*

#### DR-REQ-382186/A-Multiple Charge Ports - Cord Unlock Request

|  |  |  |
| --- | --- | --- |
| **Title**  **Multiple Charge Ports - Cord Unlock Request** | **ID**  DR-REQ-382186 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the vehicle is plugged into multiple charge ports, the BCCM shall respond to the various cord unlock requests according to the following table:

|  |  |
| --- | --- |
| **Unlock request source** | **Action taken** |
| AC Port CSI | Unlock the AC Charge Port (follow all AC Unlock requirements) |
| DC Port CSI | Terminate the charging session |
| SYNC Soft Button | Terminate the charging session |

*Rationale/Notes*

*The customer should be able to unlock and remove the AC charge port if both ports are plugged in, but priority should be given to the DC Charge port in terms of both charging and soft button unlock.*

## SR-REQ-137810/A-Hold-Off Charging after Charge Complete

|  |  |  |
| --- | --- | --- |
| **Title**  **Hold-Off Charging after Charge Complete** | **ID**  SR-REQ-137810 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  003400\_HEV - Electrified Powertrain System | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links**  DR-REQ-238478/A-Hold-Off after Charge Complete[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SHadP$SPx3NrTD)]  DR-REQ-271263/A-FMEM - Charge Target Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TgRl2oFxx3NrTD)] | |
| **Verified By Test Method(s)**  TST-REQ-266361/B-Hold off Charging after Charge Complete | | |

**Description**

**Hold-Off Charging after Charge Complete**

The Plug In Charging System shall not re-enter HV Charging after Charge Complete until:

* All system conditions defined in SR-REQ-137806 are true

AND

* + Plug Status (PlgActv\_D\_ActlChrgr) has transitioned from ON PLUG to OFF PLUG and back to ON PLUG (i.e. the plug has been re-inserted)

OR

* + The vehicle key state (Ignition\_Status) has transitioned from OFF(0x1) to RUN (0x4)

OR

* + BSOC drops below a calibratable hysteresis of the target SoC (BattChrgTrgtSoC\_Pc\_Rq)

OR

* + 12V Battery Support is requested (ULoSrcOnPlg\_B\_Cmd = 1)(See DR-REQ-XXXXX)

*Rationale/Notes:*

### DR-REQ-238478/A-Hold-Off after Charge Complete

|  |  |  |
| --- | --- | --- |
| **Title**  **Hold-Off after Charge Complete** | **ID**  DR-REQ-238478 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137810/A-Hold-Off Charging after Charge Complete[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=h_WVw6x1x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Hold-Off Charging after Charge Complete**

The BECM shall not be permitted to re-enter HV charging after completing a charge unless the following conditions are true:

* All system conditions defined in SR-REQ-137806 are true

AND

* + Plug Status (PlgActv\_D\_ActlChrgr) has transitioned from ON PLUG to OFF PLUG and back to ON PLUG (i.e. the plug has been re-inserted)

OR

* + The vehicle key state (Ignition\_Status) has transitioned from OFF(0x1) to RUN (0x4)

OR

* + BSOC drops below a calibratable hysteresis of the target SoC (BattChrgTrgtSoC\_Pc\_Rq)

OR

* + 12V Battery Support is requested (ULoSrcOnPlg\_B\_Cmd = 1)(See DR-REQ-XXXXX)

*Rationale/Notes*

*There are some conditions under which the contactors need to close after charge is complete.*

*Any time there is a change in plug status, the charging system must re-evaluate it’s need for charging*

*If the vehicle is keyed on, even while on plug, contactors must close to turn on the vehicle.*

*If the BSoC ever falls too low, charging must re-initiate to charge back up to 100% (or the requested target)*

*The case of thermal conditioning being requested is covered by the above hysteresis – if the thermal conditioning system (cabin or battery) brings the SoC below the threshold, the BECM will re-initiate charging and maintain the targeted SoC*

*The 12V systems needs to close contactors to keep the 12V battery alive every 24 hours. The contactors must close during this time to charge the 12V battery.*

*All other system conditions (PRNDL in Park, HPCM is not inhibiting, BECM and BCCM are OK to charge) must still be true as defined in the Conditions for Charging SR. It is assumed that the Charge Inhibit flag from the HPCM will be either be “allow charging” or “Maintain target SoC” after charge complete is reached in order to allow the contactors to close for any of the above situations.*

### Charge Target FMEM Actions (470790; A)

#### DR-REQ-271263/A-FMEM - Charge Target Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Charge Target Signal** | **ID**  DR-REQ-271263 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137810/A-Hold-Off Charging after Charge Complete[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=h_WVw6x1x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Charge Target Signal is Missing (BattChrgTrgtSoC\_Pc\_Rq), the BECM shall assume the target as the last known value.

*Rationale/Notes*

*Since the HPCM will be asleep for most of a charge event, the BECM should treat a missing Charge Target Signal as the last known value.*

## SR-REQ-193480/B-Cord Lock/Unlock Requirements

|  |  |  |
| --- | --- | --- |
| **Title**  **Cord Lock/Unlock Requirements** | **ID**  SR-REQ-193480 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  003400\_HEV - Electrified Powertrain System | |  |
| **Legacy ID** | | |
| **Vehicle Configuration** | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links**  DR-REQ-245719/C-Cord Lock Timing Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=rcUx$W2lx3NrTD)]  DR-REQ-281270/C-Cord Lock Fault Alert[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SMS16LGYx3NrTD)]  DR-REQ-193486/B-DC Fast Charge - Unlocking EVSE[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SQe562dxx3NrTD)]  DR-REQ-193485/A-Inlet Port Antenna Search Area[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iEdV8C5Lx3NrTD)]  DR-REQ-194504/A-Detection of EVSE Unlock Button[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=RydVOSaBx3NrTD)]  DR-REQ-213392/A-Unlocking Cord Set - Center Stack Soft Button[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i3XZvTlox3NrTD)]  DR-REQ-193488/A-DC Fast Charge - Cord Lock During Power Transfer[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ycWV8C5Lx3NrTD)]  DR-REQ-193482/A-Uncharge port  ing Cord Set Button - Inlet Port Housing[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CQRV8C5Lx3NrTD)]  DR-REQ-271058/B-Unlocking EVSE FMEM - CSI Stuck Button[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ilWtRVJ8x3NrTD)]  DR-REQ-271057/A-Unlocking EVSE FMEM - APIM Missing Message[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i7Ul1X52x3NrTD)]  DR-REQ-242195/A-FMEM - Unlocking EVSE[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=zuehCLMCx3NrTD)]  DR-REQ-258010/B-AC Charging Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i7UpXf4Ax3NrTD)]  DR-REQ-271059/B-Cord Re-lock strategy for EU[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=jFZ1rpHkx3NrTD)] | |
| **Verified By Test Method(s)**  TST-REQ-293334/B-Cord Lock/Unlock - EU DC Charging  TST-REQ-266362/B-Cord Lock/Unlock - North America  TST-REQ-293333/B-Cord Lock/Unlock - EU AC Charging | | |

**Description**

**Inlet Cord Lock/Unlock Requirements**

The Plug in Charging system shall lock the charge cord to the charge port for DC fast charging or for AC charging, depending on market and architectures defined in the table below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Standard** | **Lock for PHEV AC Charging** | **Lock for BEV AC Charging** | **Lock for BEV DC Charging** |
| SAE J1772 (North America) | No | No | Yes |
| IEC 62196 (EU) | Yes | Yes | Yes |
| GB/T 18487 (China) | No (Input Current ≤ 16 Amps) | Yes | Hardware and Controls build into EVSE (Not required on the vehicle) |

*Note: The locking during DC fast charging is for prevention of arching; it is preferred that the charger stop charging and then unlock the cord.*

*In European markets the cord sets are not attached to the charging stations, they are plugged into a grid, so they can be stolen if they are not locked to the vehicle. This is defined in IEC 62196 Part 2 S14 for AC Charging and Part 3 S14.301 for DC Charging*

*In China markets, vehicles must be equipped with a lock if they are capable at charging at 16 Amps or greater, except for DC Fast charge, as the locking hardware is contained in the EVSE handle and not in the vehicle. This is defined in GBT18487.1 S5.2.2.3.*

*The requirements for locking the cord in NA for DC Charging is contained in SAE J1772 S6.5.1*

### DC Cord Unlock Requirements (470661; B)

#### DR-REQ-193486/B-DC Fast Charge - Unlocking EVSE

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge - Unlocking EVSE** | **ID**  DR-REQ-193486 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links**  DR-REQ-193490/B-DC Fast Charge - Unlock Request[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iEW1$WWfx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**DC Fast Charge – Unlocking EVSE**

**This requirement is for North America, Europe and Asia Pacific vehicles.**

Depending on the market, the charger shall unlock the EVSE Plug when a DC Fast Charge is complete, or when a valid unlock request is received (See DR-REQ-193490).

In addition, the DC Charge Contactor Voltage (BattDcChrg\_U\_Actl) must be below 60V.

|  |  |  |
| --- | --- | --- |
| **Market** | **Unlock on DCFC Complete or request** | **Unlock on request only** |
| *North America* | X |  |
| *Europe* |  | X |
| *China* | X |  |

*Rationale/Notes*

*Europe must stay locked after charge complete because it relies on the actuating pin to hold the DC cord to the charge port. NA and China have separate latches for holding the cord to the charge port and locking the cord to the charge port.*

*The DC Charge Contactors must be below 60V before unlocking the cord per J1772 standards.*

##### DR-REQ-193490/B-DC Fast Charge - Unlock Request

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge - Unlock Request** | **ID**  DR-REQ-193490 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-193486/B-DC Fast Charge - Unlocking EVSE[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SQe562dxx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DC Fast Charge – Unlock Request**

**This requirement is for all markets.**

The BCCM shall consider a DCFC Unlock Request fulfilled if the Charge Mode is DC Fast Charge (ChrgrInPwMde\_D\_Actl = 0x5) and the following conditions are true:

1. The charge mode is DC Fast Charge or Digital Comm Detected (ChrgrInPwMde\_D\_Actl = 0x5, 0x2)

AND

1. Either
   1. The CSI Unlock Button is pressed

OR

* 1. A cord unlock is requested from the APIM (ChrgCordUnlock\_B\_Rq = 0x1)

*Note: No key fob search or door lock status is required for DC Fast Charging. There is a master button on the charging stations for shutting down charging which will result in a cord set unlock and the DC Fast Charge cords are attached to the DC Fast Charge Stations, so no security is required for the cord set.*

#### DR-REQ-193488/A-DC Fast Charge - Cord Lock During Power Transfer

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge - Cord Lock During Power Transfer** | **ID**  DR-REQ-193488 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DC Fast Charge – Cord Lock During Power Transfer**

The charge EVSE shall remain locked during DC fast charge power transfer.

#### DR-REQ-369554/A-DC Cord Lock - BECM Available

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Cord Lock - BECM Available** | **ID**  DR-REQ-369554 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall lock the charge cord for DC charging only if communication with the BECM is present.

*Notes/Rationale:*

*For all DC locking, the BCCM requires the DC input voltage to be less than 60V (See DR-REQ-193486). If the BECM is missing, then the BCCM knows that it may not be able to unlock, and that locking could potentially disable the vehicle. In order to avoid this, the BCCM should not lock the cord.*

### AC Cord Unlock Requirements (470662; B)

#### ~~DR-REQ-258010/B-AC Charging Unlock Requirements~~

|  |  |  |
| --- | --- | --- |
| **Title**  **AC Charging Unlock Requirements** | **ID**  DR-REQ-258010 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links**  DR-REQ-193483/C-Conductive Charging - Cord Unlock Request[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SsV5Bl6Px3NrTD)]  DR-REQ-271247/B-AC Cord Lock - APIM Enable[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=yiepMlh2x3NrTD)]  DR-REQ-193495/C-Conductive Charging - Unlocking Cord Set[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i5c16LGYx3NrTD)]  DR-REQ-193484/A-CAN Request for Secure Cord Unlock - BCM[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SoYV8C5Lx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**~~Description~~**

**~~AC Charging Unlock Requirements~~**

~~The vehicle shall be capable of unlocking the charge cord during AC charging in markets where required.~~

##### DR-REQ-193483/C-Conductive Charging - Cord Unlock Request

|  |  |  |
| --- | --- | --- |
| **Title**  **Conductive Charging - Cord Unlock Request** | **ID**  DR-REQ-193483 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV], BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-258010/B-AC Charging Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i7UpXf4Ax3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**AC Conductive Charging – Cord Unlock Request**

**This requirement is for European Markets on Vehicles equipped with PEPS.**

The charger shall request a secure unlock from the BCM using a custom security code if the following conditions are true:

1. The charge mode is Paused, AC Basic, Digital Comm Detected, AC Digital, or EVSE Not Detected (ChrgrInPwMde\_D\_Actl = 0x0, 0x1, 0x2, 0x3, 0x4)

AND

1. Either
   1. The CSI Unlock Button is pressed

OR

* 1. A cord unlock is requested from the APIM (ChrgCordUnlock\_B\_Rq = 0x1)

*Rationale/Notes:*

*The algorithm is defined in the BCM Charge Port Function Spec.*

*The CAN signals used for the custom security code are as follows:*

* *ChrgCordChlng1\_No\_Actl*
  + *MSB of the challenge code from the BCCM to request a charge port unlock*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCCM*
  + *Rx: BCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordChlng2\_No\_Actl*
  + *LSB of the challenge code from the BCCM to request a charge port unlock*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCCM*
  + *Rx: BCM*
  + *Initial Value: 0*
  + *Domain: 0-255*

*Additionally, the challenge code and response is based on the vehicle’s VIN number (VehicleGGCCData) per the BCM Charge Port Function Spec.*

##### DR-REQ-193495/C-Conductive Charging - Unlocking Cord Set

|  |  |  |
| --- | --- | --- |
| **Title**  **Conductive Charging - Unlocking Cord Set** | **ID**  DR-REQ-193495 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-258010/B-AC Charging Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i7UpXf4Ax3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**AC Conductive Charging – Unlocking Cord Set**

**This requirement is for European Markets and North American BEVs.**

The Charging System shall unlock the conductive cord set if following conditions are met:

1. The charge cord is locked (ChrgCordLck\_D\_Stat = 0x2 Locked) or confirmed to be “retain” (ChrgCordLck\_D\_Stat = 0x0)

AND

1. Either
   1. The BCM indicates that a valid key fob was found and it is OK to unlock (ChrgCordLck\_B\_Stat = 0x1) AND the message is validated using a challenge/response algorithm.

OR

* 1. The BECM charge status is “Charge Complete” (BattChrgRdy\_D\_Stat = 0x4) (North American BEVs only)

AND

1. S2 is Open

AND

1. AC Voltage < 50V

*Rationale/Notes:*

*For North American BEVs, the cord is only locked in order to allow the customer to fully charge without another plug-in owner taking their charge cord. Once charging has completed, the customer is no longer concerned with “holding” the charger in a public station, and would rather have it unlocked and available for other customers.*

*See Charge Port unlock Feature Spec for details*

*In order to secure the charge cord, the charger will only unlock the cord after an authorized code has been received from the BCM indicating that a key fob is detected. The algorithm is defined in the BCM Charge Port Function Spec.*

*The CAN signals for unlocking are described below. The Challenge and Response signals are divided into MSB and LSB to allow for differences in endianness.*

* *ChrgCordLck\_B\_Stat*
  + *Unlock command from BCM*
  + *Size: 1 bit*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *States*
    - *0x0 – NULL*
    - *0x1 – UNLOCK*
* *ChrgCordChlng1\_No\_Actl*
  + *MSB of the challenge code from the BCCM to request a charge port unlock*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCCM*
  + *Rx: BCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordChlng2\_No\_Actl*
  + *LSB of the challenge code from the BCCM to request a charge port unlock*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCCM*
  + *Rx: BCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordResp1\_No\_Actl*
  + *MSB of the response code from the BCM to unlock the charge port*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordResp2\_No\_Actl*
  + *LSB of the response code from the BCM to unlock the charge port*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *Domain: 0-255*

*Additionally, the challenge code and response is based on the vehicle’s VIN number (VehicleGGCCData) per the BCM Charge Port Function Spec.*

*“Confirmed to be retain” means that the status is retain (power up default) and has been confirmed to be in the retain state after reading the lock actuator pins.*

###### DR-REQ-316891/A-Unlocking FMEM - AC Voltage

|  |  |  |
| --- | --- | --- |
| **Title**  **Unlocking FMEM - AC Voltage** | **ID**  DR-REQ-316891 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the AC Voltage has been greater than 50V for 5s and all other cord unlock requirements are met, the BCCM shall set a DTC against the EVSE and unlock the charge cord.

*Rationale/Notes:*

*In some cases, the AC voltage may not drop below 50V. Since there is no risk of electric shock or arc, it is safe to unlock and allow the cord to be unplugged, but the charger should set an informational DTC against the EVSE.*

##### DR-REQ-193484/A-CAN Request for Secure Cord Unlock - BCM

|  |  |  |
| --- | --- | --- |
| **Title**  **CAN Request for Secure Cord Unlock - BCM** | **ID**  DR-REQ-193484 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  191001\_Body Control Module | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-258010/B-AC Charging Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i7UpXf4Ax3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**CAN Request for Secure Cord Unlock – BCM**

When a CAN message for a Secure Cord Unlock is received from the charger the BCM shall send a message to the charger indicating that a cord unlock is authorized if the following conditions are true:

1. The vehicle doors are unlocked

OR

1. A key fob search has been initiated and a valid key fob has been detected within range of the vehicle

The BCM shall also send a valid security key in response to the challenge code sent by the BCCM.

*Note: Due to security it was recommended that the search area be limited to the Inlet Port external area, if the car is unlocked someone can press the unlock charge cord button and unlock the cord set.*

*The algorithm is defined in the BCM Charge Port Function Spec.*

*The signals sent by the BCM responding to the challenge code are as follows:*

* *ChrgCordResp1\_No\_Actl*
  + *MSB of the response code from the BCM to unlock the charge port*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordResp2\_No\_Actl*
  + *LSB of the response code from the BCM to unlock the charge port*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordLck\_B\_Stat*
  + *Unlock status of the charge port*
  + *Size: 1 bit*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *States*
    - *0x0 – NULL*
    - *0x1 – UNLOCK*

*Additionally, the challenge code and response is based on the vehicle’s VIN number (VehicleGGCCData) per the BCM Charge Port Function Spec.*

##### DR-REQ-271247/B-AC Cord Lock - APIM Enable

|  |  |  |
| --- | --- | --- |
| **Title**  **AC Cord Lock - APIM Enable** | **ID**  DR-REQ-271247 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  150102\_Center Stack Display | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-258010/B-AC Charging Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i7UpXf4Ax3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

~~In North American Markets, the APIM shall include a screen to allow the customer to enable or disable AC Cord Lock. It shall send a signal to the BCCM saying if AC Cord Lock is Enabled or Disabled.~~

~~Signal Definition~~

~~Signal Name: ChrgCrdLckEnbl\_B\_Stat~~

~~Size: 1 bit~~

~~Values:~~

* ~~0x0 – Not Enabled~~
* ~~0x1 – Enabled~~

~~Rate: 1000 ms E/P~~

~~Tx: APIM~~

~~Rx: BCCM~~

*Rationale/Notes:*

*This requirement is currently not being implemented*

#### DR-REQ-295883/A-AC Cord Lock - BCM Available

|  |  |  |
| --- | --- | --- |
| **Title**  **AC Cord Lock - BCM Available** | **ID**  DR-REQ-295883 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall lock the charge cord for AC locking only if communication with the BCM is present.

*Notes/Rationale:*

*For all AC locking, the charger knows that cord lock authentication will fail if the BCM is missing from the network. In order to prevent the customer from disabling their vehicle in such a scenario, the BCM must be present to lock the charge cord. Note that this does not mean the charger should unlock the charge cord of the BCM goes missing after locking – this would be defeat the purpose of the cord lock authentication and is not desired.*

### Shared Cord Unlock Requirements (470663; B)

#### DR-REQ-271059/B-Cord Re-lock strategy for EU

|  |  |  |
| --- | --- | --- |
| **Title**  **Cord Re-lock strategy for EU** | **ID**  DR-REQ-271059 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

In EU markets, the charger shall lock the charge cord after a cord unlock command if the charge cord is “Unlocked” (ChrgCordLck\_D\_Stat = 0x1) and the plug status is “Plugged in” (PlgActv\_D\_ActlChrgr = 0x1) for 60s (calibratable).

*Notes/Rationale*

*Since EU relies on the cord lock to hold the charge port in the charge port inlet, a re-lock strategy must be in place in case the customer unlocks the cord but does not remove it from the charge port inlet.*

##### ~~DR-REQ-369553/A-HEV Wake for cord re-lock~~

|  |  |  |
| --- | --- | --- |
| **Title**  **HEV Wake for cord re-lock** | **ID**  DR-REQ-369553 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

#### DR-REQ-193482/A-Unlocking Cord Set Button - Inlet Port Housing

|  |  |  |
| --- | --- | --- |
| **Title**  **Unlocking Cord Set Button - Inlet Port Housing** | **ID**  DR-REQ-193482 | **Revision**  A  **Status**  Released |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-232138/A-Cord Unlock Button[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=BvZdZ_D$x3NrTD)]  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**EVSE Unlocking Button – Inlet Port Housing**

**This is for the European Markets and NA markets with DC fast Charge**

The inlet port housing shall be equipped with a button that can wake the BCCM and request a cord unlock.

*Note: The Inlet Port button can be hard wired to the BCCM, or it can be included as part of a module that sends a message to the BCCM via LIN or CAN.*

*In Gen IV vehicles, the inlet port button is a component of the Charge Status Indicator. The CSI will wake the BCCM over LIN when the inlet button is pushed, and send the request for charge cord unlock.*

#### DR-REQ-193485/A-Inlet Port Antenna Search Area

|  |  |  |
| --- | --- | --- |
| **Title**  **Inlet Port Antenna Search Area** | **ID**  DR-REQ-193485 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To** | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Inlet Port Antenna Search Area**

**This requirement is for PEPS vehicles in EU (Not Passive Start Only).**

The external antenna shall detect the key fob on the exterior of the vehicle, within 1 meter but no greater than 2.0 meter of the plug-in vehicle Inlet Charge Port.

*Note: This can be accomplished using an existing antenna or with the addition of a new antenna if required. Cascade to 191201.*

#### DR-REQ-194504/A-Detection of EVSE Unlock Button

|  |  |  |
| --- | --- | --- |
| **Title**  **Detection of EVSE Unlock Button** | **ID**  DR-REQ-194504 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Detection of EVSE Unlock Button**

The BCCM shall be capable of waking if the EVSE Unlock Button is pressed.

*Rationale/Notes:*

*The Unlock Button will be incorporated into the CSI module at the charge port, and will wake the BCCM over a LIN network when pressed.*

#### DR-REQ-213392/A-Unlocking Cord Set - Center Stack Soft Button

|  |  |  |
| --- | --- | --- |
| **Title**  **Unlocking Cord Set - Center Stack Soft Button** | **ID**  DR-REQ-213392 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  150102\_Center Stack Display | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Unlocking Cord Set – Center Stack Soft Button**

The APIM shall include a “soft button” on the touch display that, when pushed, commands the BCCM to unlock the charge cord via a CAN signal.

*Rationale/Notes*

*The BCCM will still authenticate with the BCM for a valid key fob or doors unlocked if it gets an APIM unlock request. The algorithm is defined in the BCM Charge Port Function Spec.*

*Signal:*

* *ChrgCordUnlock\_B\_Rq*
  + *APIM Unlock Request*
  + *Size: 1 bit*
  + *Rate: 1000 EP*
  + *Tx: APIM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *States*
    - *0x0 – No Request*
    - *0x1 – Request*

#### DR-REQ-245719/C-Cord Lock Timing Requirements

|  |  |  |
| --- | --- | --- |
| **Title**  **Cord Lock Timing Requirements** | **ID**  DR-REQ-245719 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links**  DR-REQ-245725/C-Cord Lock Timing - AC Digital Unlock[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SYV15HHdx3NrTD)]  DR-REQ-242194/B-FMEM - Locking EVSE[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i6atRVJ8x3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**Cord Lock Timing Requirements**

For all EVs, cord actuator shall lock within 2000ms when the vehicle is not in a torque producing mode (PwPckTq\_D\_Stat !=0x3) AND the Pilot or Prox is present with the correct value based on marked in the table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Market* | Never Lock | Lock when Pilot = 5% AND ChrgrInPwMde\_D\_Actl = 0x2, 0x5 | Lock when  [Pilot > 0 OR Prox is detected] | Lock when  [Pilot > 0 OR Prox is detected] AND ChrgCrdLckEnbl\_B\_Stat = 0x1 ENABLED |
| EU (BEV & PHEV) |  |  | X |  |
| NA (BEV) |  | X |  | X |
| NA (PHEV) | X |  |  |  |
| China (BEV) |  |  | X |  |
| China (PHEV) | X |  |  |  |

*Notes/Rationale:*

*In EU, the cord lock is necessary to secure the EVSE to the car. Thus, the vehicle should lock as soon as possible when any pilot or prox is detected.*

*In NA, cord lock is only needed for DC fast charge, which can only occur if the pilot is 5% (digital communication) REQ-245725 details the unlock step necessary if the digital communication transforms into AC Digital.*

*In China, only the BEV needs the AC cord locked, but it is not constrained to DC only as the AC chargers are capable of exceeding 16A.*

##### DR-REQ-245725/C-Cord Lock Timing - AC Digital Unlock

|  |  |  |
| --- | --- | --- |
| **Title**  **Cord Lock Timing - AC Digital Unlock** | **ID**  DR-REQ-245725 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-245719/C-Cord Lock Timing Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=rcUx$W2lx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Cord Lock Timing – AC Digital Unlock**

In the NA market, if

1. the lock actuator is engaged (ChrgCordLck\_D\_Stat = 0x2)

AND

1. the Charger Mode changes to “AC Basic” or “AC Digital” (ChrgrInPwMde\_D\_Actl = 0x3, 0x4)

AND

1. The AC Cord Lock Enable is “Not Enabled” (ChrgCrdLckEnbl\_B\_Stat = 0x0)

then the BCCM shall unlock the cord within 2000ms.

*NA market BEVs do not require cord lock on AC charging. Since the cord locks when digital communication is detected, additional logic is required to unlock the cord in the case of an EVSE that communicates via PLC.*

##### DR-REQ-354198/A-Re-lock cord after BCB Toggle

|  |  |  |
| --- | --- | --- |
| **Title**  **Re-lock cord after BCB Toggle** | **ID**  DR-REQ-354198 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall re-lock the charge cord if the following conditions are true:

* The charge cord is unlocked
* The charger has performed a BCB Toggle
* The EVSE Status is “Digital Communication Detected”, “DC Charging” or “AC Digital Charging”
* The BECM charge status is “Charge Wait”

*Rationale/Notes*

*BCB toggle is a strategy for the BCCM to reset a digital charging system after communication has failed. See charger IFS for BCB Toggle requirements.*

#### Cord Lock/Unlock FMEM Actions (470791; B)

##### DR-REQ-271058/B-Unlocking EVSE FMEM - CSI Stuck Button

|  |  |  |
| --- | --- | --- |
| **Title**  **Unlocking EVSE FMEM - CSI Stuck Button** | **ID**  DR-REQ-271058 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the CSI is reporting an unlock button press for more than 30 seconds (calibratable), then it can assume the Cord Unlock button is stuck.

If the charger determines that the cord unlock button is stuck, then it must take the following FMEM actions:

* Set a “Stuck Cord Unlock Button” DTC
* Ignore all future Unlock commands from the CSI until the CSI button state changes to “Not Pressed” – retain the Stuck Unlock Button Status in memory after shutdown.

*Rationale/Notes:*

*The CSI will only send a wakeup on button change – so only the first press of a stuck button will wake up the BCCM. After detecting a lock, the BCCM should retain the value of the stuck button in memory until the CSI reports the button to be “not pressed”. Without this, the BCCM would obey the button press on every new EV Wake, which would be especially disruptive for the charge change button.*

##### DR-REQ-271057/A-Unlocking EVSE FMEM - APIM Missing Message

|  |  |  |
| --- | --- | --- |
| **Title**  **Unlocking EVSE FMEM - APIM Missing Message** | **ID**  DR-REQ-271057 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the APIM Cord Unlock Command message (ChrgCordUnlock\_B\_Rq) is missing, the charger shall set an informational DTC.

*Rationale/Notes*

*It is important to note the missing message, but the charger should take no other action, as it is important to not unlock the charge cord unless absolutely necessary.*

##### DR-REQ-242195/A-FMEM - Unlocking EVSE

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Unlocking EVSE** | **ID**  DR-REQ-242195 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the inlet port cord unlock fails (after re-try), the BCCM shall perform the following FMEM actions:

* Cease charging the HV battery
* Set a DTC for cord unlock error
* Set the Cord Lock Status to “Unlock Fail” (ChrgCordLck\_D\_Stat = 0x5)
* Send a “Cord Lock Stuck” message to the cluster (NEED SIGNAL) change to APIM Refer to 5.7.3\_1.1.1.1.25
* Set the CSI to display an internal fault state

*Rationale/Notes*

##### DR-REQ-281270/C-Cord Lock Fault Alert

|  |  |  |
| --- | --- | --- |
| **Title**  **Cord Lock Fault Alert** | **ID**  DR-REQ-281270 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the charge cord is locked and a fault is detected, the BCCM shall alert the cluster and APIM of a cord lock fault using the Charge Cord Lock Fault signal (ChrCrdLck\_D\_Falt) according to the fault matrix below:

|  |  |
| --- | --- |
| **Failure** | **ChrgCrdLck\_D\_Falt** |
| CSI Stuck Button Pressed (See DR-REQ-271058) | 0x1 – CsiFault |
| CSI – Lost LIN Communication | 0x1 – CsiFault |
| Cord Lock Actuator Failure | 0x2 – HardwareFault |
| BCM Missing Communication DTC | 0x2 – HardwareFault |
| BECM Missing Communication DTC | 0x2 – HardwareFault |
| DC Input voltage is too high to unlock | 0x2 – HardwareFault |

*Rationale/Notes*

*HMI exists to inform the customer that there is a cord lock system fault that is preventing them from unlocking and removing the charge cord, and thus from moving the vehicle (due to torque disable while on plug). This HMI will direct the customer to the proper failure override so they can get their car moving under its own power again so they can drive to a dealership for repair.*

##### DR-REQ-242194/B-FMEM - Locking EVSE

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Locking EVSE** | **ID**  DR-REQ-242194 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-245719/C-Cord Lock Timing Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=rcUx$W2lx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**FMEM – Locking EVSE**

If the cord lock operation fails (after a re-try attempt), the BCCM shall implement the following FMEM protocols:

1. Set a DTC against the cord lock
2. Transition to a “not ready to charge” state (ChrgrRdyStat\_D\_Actl = 0x0)
3. Set the cord lock status to “Lock Fail” (ChrgCordLck\_D\_Stat = 0x6)
4. Display a “Faulted” state on the CSI

*Rationale/Notes*

*Charging needs to be disabled in the event of a cord lock failure.The customer must be notified that their vehicle is not charging, but a dealer must be able to differentiate a cord lock issue from a BCCM issue.*

##### DR-REQ-333361/A-Cord Lock Fault Alert - Center Stack Display

|  |  |  |
| --- | --- | --- |
| **Title**  **Cord Lock Fault Alert - Center Stack Display** | **ID**  DR-REQ-333361 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  150102\_Center Stack Display | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The APIM Center Stack shall display a cord unlock fault popup based on the cord unlock fault signal (ChrgCrdLck\_D\_Falt) from the BCCM according to the following table:

When the customer closes the “Unlock button failure. Press Close to unlock” popup, the APIM shall send a charge cord unlock request (ChrgCrdUnlock\_B\_Rq = 0x1) to the BCCM (See DR-REQ-213392 for signal details).

|  |  |
| --- | --- |
| ChrgCrdLck\_D\_Falt State | Popup to display |
| 0x0 NoFault | No popup |
| 0x1 CsiFault | “Unlock button failure. Press Close to unlock” |
| 0x2 HardwareFault | “Cord lock system failure. See owner’s manual” |

*Rationale/Notes*

*If the charge cord unlock system fails, the customer may be unable to unlock their charge cord and thus unable to drive their vehicle. The charge cord unlock fault popup exists to guide the customer to an alternative unlock method in the event that the hard unlock button fails.*

## SR-REQ-209498/C-DC Fast Charge

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge** | **ID**  SR-REQ-209498 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  003400\_HEV - Electrified Powertrain System | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links**  DR-REQ-242121/A-DCFC BECM Isolation Detection Disable[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=Tlahiy_4x3NrTD)]  DR-REQ-221997/A-DC Fast Charge End Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TYadTnKQx3NrTD)]  DR-REQ-242077/A-DC Fast Charge Inhibit Override[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=jkbhSaLRx3NrTD)]  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | |
| **Verified By Test Method(s)**  TST-REQ-266363/B-DC Fast Charge | | |

**Description**

**DC Fast Charge**

The vehicle shall begin charging once all conditions from the DCGM, BECM, BCCM, and HPCM are met to begin charging, and the charge cord is locked to the charge port. Charging shall continue as long as the conditions to continue charging are met. Charging shall end if any of the conditions from the BECM, BCCM, or HPCM to end charging are met, or the charge cord is unlocked.

Additionally, the vehicle shall override the normal Charge Inhibit if DC charging is detected, and the vehicle will disable DC Charge Cabin Conditioning above a calibratable SoC.

### DR-REQ-221996/B-DC Fast Charge Start Charging Requirements

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge Start Charging Requirements** | **ID**  DR-REQ-221996 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-209498/C-DC Fast Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iMf1lqrFx3NrTD)] | **Down-Links**  DR-REQ-242118/B-DCFC DCGM Charge Initialization[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=C8XxLsSFx3NrTD)]  DR-REQ-242074/A-DCFC BECM Charge Wait[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=y3XhSaLRx3NrTD)]  DR-REQ-242120/A-DCFC BCCM Charge Ready[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=D9Xhiy_4x3NrTD)]  DR-REQ-242124/A-DCFC BECM Charge Ready[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=Dabhiy_4x3NrTD)]  DR-REQ-242122/B-DCFC DCGM Cable Check and Precharge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SpVxLsSFx3NrTD)]  DR-REQ-242128/B-DCFC BECM Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i8Q1Ttt5x3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC Start Charging Requirements**

The DCGM shall begin charging if the following system conditions are true:

1. The BCCM charge status is “Charger Ready” (ChrgrRdyStat\_D\_Actl = 0x1)

AND

1. The BECM charge Status is “Charge Ready” (BattChrgRdyStat\_D\_Actl = 0x2)

AND

1. The EVSE is ready to deliver power.

AND

1. The DCGM is ready to transfer power.

*Rationale/Notes*

*Special requirements DC charging (such as locking the cordset) can be found in the requirements BCCM and BECM Charge Ready requirements*

#### DR-REQ-242074/A-DCFC BECM Charge Wait

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC BECM Charge Wait** | **ID**  DR-REQ-242074 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC BECM Charge Wait**

The BECM shall transition to “Charge Wait” when the following system conditions are true:

1. The HPCM Charge Inhibit status is NOT “Inhibit Charging” (BattChrgInhbt\_D\_Rq != 0x01)

AND

1. The Charge Mode is “Digital Comm Detected” (ChrgrInPwMde\_D\_Actl =0x2) or “DC Charge (ChrgrInPwMde\_D\_Actl = 0x05)

AND

1. The SOC is below a calibratable Charge Threshold (BattTracSoC\_Pc\_Actl < 98%; calibratable)

AND

1. The BECM is ready to transition to “Charge Wait”

**Rationale/Notes**

*HPCM will never send “Inhibit Charging” if the charge mode is Digital Comm Detected or DC Charging.*

*DC Charging should only begin when the vehicle is below an SOC that will allow DC charging. Otherwise, the system should default to AC Digital Charging.*

#### DR-REQ-242118/B-DCFC DCGM Charge Initialization

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC DCGM Charge Initialization** | **ID**  DR-REQ-242118 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC DCGM Charge Initialization**

The DCGM shall initialize the digital communication when the following system conditions are true

1. The Charge Mode is “Digital Comm Detected” (ChrgrInPwMde\_D\_Actl = 0x2)

AND

1. The BCCM Charge Mode Command is “Attempt Digital Communication” (DgtlCommGtwyMde\_D\_Rq = 0x1)

AND

1. The DCGM is ready to initialize digital communications

When completed, the DCGM shall set the DCGM Charge Status to “Charge Ready” (DcChrgRdy\_D\_Stat = 0x2)

*Rationale/Notes*

*DC Charge Initialization begins once the BECM is in Charge Wait. Setting the Charge Service to DC Charge notifies the BCCM to enable CPE and transition the charge mode to DC Charging.*

#### DR-REQ-242120/A-DCFC BCCM Charge Ready

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC BCCM Charge Ready** | **ID**  DR-REQ-242120 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC BCCM Charge Ready – NA and EU**

The BCCM shall close S2 and transition to “Charge Ready” when the following system conditions are true:

1. The DCGM Charge Status is “DC Charge Ready” (DcChrgRdy\_D\_Stat = 0x2)

AND

1. The Charge Cord is Locked (ChrgCordLck\_D\_Stat = 0x2)

AND

1. The BECM Isolation Detection is “Disabled” (BattTracIsoDis\_B\_Stat = 0x1)

AND

1. The BECM Charge Status is “Charge Wait” (BattChrgRdyStat\_D\_Actl = 0x1)

AND

1. The vehicle is in PARK (GearLvrPos\_D\_Actl = 0x0)

AND

1. The vehicle is NOT in a torque producing mode (PwPckTq\_D\_Stat != 0x3)

AND

1. The BCCM is ready to transition to “Charge Ready”

*Rationale/Notes*

*The above system conditions verify that the vehicle is ready to accept a DC charge. Once the BCCM transitions to Charge Ready the DCFC will initiate the precharge process*

#### DR-REQ-242122/B-DCFC DCGM Cable Check and Precharge

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC DCGM Cable Check and Precharge** | **ID**  DR-REQ-242122 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC DCGM Cable Check and Precharge**

The DCGM shall perform a cable check and transition to “Precharge” when the following system conditions are true:

1. BCCM Charge Status is “Charger Ready” (ChrgrRdyStat\_D\_Actl = 0x1)

AND

1. S2 is closed (ChrgrS2Swtch\_B\_Stat = 1)

AND

1. The DCGM is ready to perform a cable check

*Rationale/Notes*

*The BCCM transitioning to “charge ready” is an indication that S2 is closed and the DCGM can begin cable check. Once cable check is complete the DCGM can transition to the “Precharge” state.*

*This requirement only applies to NA and EU markets. In China, the EVSE will perform the cable check and precharge the bus after the contactors are closed*

#### DR-REQ-242124/A-DCFC BECM Charge Ready

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC BECM Charge Ready** | **ID**  DR-REQ-242124 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC BECM Charge Ready**

The BECM shall not transition to “Charge Ready” unless the following System Conditions are true:

1. The DCGM Charge Status is “PreCharge” (DcChrgRdy\_D\_Stat = 0x4) (NA &EU)

OR

The DCGM Charge Status is “GBTPreCharge” (DcChrgRdy\_D\_Stat = 0x7) (CH)

AND

1. The BECM is ready to transition to “Charge Ready”

*Rationale/Notes*

*Once the DCGM performs the cable check and is ready to close contactors, the BECM can transition to charge ready and close the DC contactors*

#### DR-REQ-242128/B-DCFC BECM Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC BECM Charging** | **ID**  DR-REQ-242128 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC BECM Charging**

The BECM shall transition to “Charging” when the following system conditions are true:

1. The BECM Charge Status is “Charge Ready” (BattChrgRdyStat\_D\_Actl = 0x2)

AND

1. The DC Charge contactors have been closed

AND

1. The DCGM Charge Status is “PreCharge” (DcChrgRdy\_D\_Stat = 0x4) (NA &EU)

OR

The DCGM Charge Status is “GBTPreCharge” (DcChrgRdy\_D\_Stat = 0x7) (CH)

AND

1. The BECM is ready to transition to “Charging”

Upon transitioning to “Charging”, the BECM shall send the voltage and current set points as necessary to charge the traction battery.

*Rationale/Notes*

*The BECM can begin charging the traction battery once the DC contactors are closed.*

#### DC Charge FMEM Actions (639904; A)

##### DR-REQ-347986/A-FMEM - DCGM Fault

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - DCGM Fault** | **ID**  DR-REQ-347986 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the DCGM status message is missing or "Faulty" (DcChrgRdy\_D\_Stat = 0xF), the BECM will stop charging and go to "Not Ready" (BattChrgRdyStat\_D\_Actl = 0x0).

##### REQ-359296/A-FMEM - BECM Charge Wait Time Out for digital communication

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - BECM Charge Wait Time Out for digital communication** | **ID**  REQ-359296 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the BECM Charge Status is “Charge Wait” and the charger input power mode is “Digital Comm Detected”, “AC Digital” or “DC Charge” for more than 240 seconds (calibratable), it will transition to “Not Ready” and set the BECM Charge Sustain to 0.

*Rationale/Notes*

*System conditions may cause the BCCM to remain in a “Not Ready” state when the BECM is in Charge Wait (e.g. the vehicle is not in park). In these cases, the BECM must be able to abort the charge sequence and shut down in order to prevent draining the 12V battery.*

*For a digital communication charge event, this time out must be increased to allow for the worst case delay in digital communication between the DCGM and the EVSE.*

### DR-REQ-221997/A-DC Fast Charge End Charging Requirements

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge End Charging Requirements** | **ID**  DR-REQ-221997 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-209498/C-DC Fast Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iMf1lqrFx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall end DC Fast Charging if any of the following conditions are true:

1. Any conditions to end conductive charging in DR-REQ-140446 are true.

OR

1. The DCGM charge ready status is “Not Ready” OR “Charge Complete” OR “EVSE Fault” OR “Faulty” (DcChrgRdy\_D\_Stat = 0x1, 0x6, 0xA, 0xF)

OR

1. The BCCM receives a hard button unlock request from the CSI

OR

1. The BCCM receives a soft button unlock request from the APIM (ChrgCordUnlock\_B\_Rq = 0x1 “Request”).

*Rationale/Notes*

*DC Fast charging follows the normal requirements for conductive charging, with some additional restraints such as ending charging via cord unlock.*

### DR-REQ-242077/A-DC Fast Charge Inhibit Override

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge Inhibit Override** | **ID**  DR-REQ-242077 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-209498/C-DC Fast Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iMf1lqrFx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DC Fast Charge inhibit Override**

If the Charge Power Mode is either “Digital Comm Detected” or “DC Charging” (ChrgrInPwMde\_D\_Actl = 0x2 OR 0x5), then the VSC shall set the charge inhibit flag to “Enable Charging” (BattChrgInhibt\_D\_Rq = 0x0)

*Rationale/Notes*

*The VSC should ignore value charge windows if the vehicle is plugged into a DC fast charger – it is expected that the customer wants the vehicle to charge immediately*

*If the EVSE is a Digital AC charger, this allows the HPCM to first override the inhibit, then bring it back if necessary when ChrgrInPwMde\_D\_Actl changes to “AC Digital”*

### DR-REQ-242121/A-DCFC BECM Isolation Detection Disable

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC BECM Isolation Detection Disable** | **ID**  DR-REQ-242121 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-209498/C-DC Fast Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iMf1lqrFx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC BECM Isolation Detection Disable**

The BECM shall disable isolation detection when

1. The Charge Mode is set to “DC Charging” (ChrgrInPwMde\_D\_Actl = 0x5)

AND

1. The Isolation Detection Disable Request signal is set to “Yes” (BattTracIsoDis\_B\_Rq = 0x1)

*Rationale/Notes*

*Since the DC contacts are directly connected to the battery (i.e. bypasses the main contactors) the isolation detection must be disabled during a DC charge to avoid invalid fault states*

### DR-REQ-312181/B-DC Fast Charge Open Contactor Request for HPCM

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge Open Contactor Request for HPCM** | **ID**  DR-REQ-312181 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The HPCM shall request the main contactors to be open (BattTracCnnct\_D\_Rq = 0x0) if the following conditions are true:

1. The Arbitrated Plug Status is “On Plug” (PlgActvArb\_B\_Actl = 0x1)

AND

1. The Charger Input Power Mode is “DC Charging” (ChrgrInPwMde\_D\_Actl = 0x5)

AND

1. The BECM Charge Status is “Charge Wait” (BattChrgRdyStat\_D\_Actl = 0x1)

AND

1. The DC Charge Status is “GBTPrecharge” (DcChrgRdy\_D\_Stat = 0x7)

AND

1. The vehicle speed is less than 5 mph (calibratable)

*Notes/Rationale*

*The DC Charge Sequence requires the main negative contactor to open in order to discharge the bus and pre charge for DC Fast Charging. This may require the HPCM to power down the vehicle in order to open the contactors and discharge – see Power Up Power Down HLF.*

*The HPCM should do this only just before the Precharge step in the China DC Fast Charge sequence. Since the whole sequence can take up to four minutes, and the HV accessories are not available while the main contactors are open, waiting for Precharge will result in the least impact to the HV accessory availability.*

*For NA and EU, the main contactors will remain closed for the duration of the contactor sequence.*

### DR-REQ-313715/A-DC Fast Charge - HPCM Close Contactor

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge - HPCM Close Contactor** | **ID**  DR-REQ-313715 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The HPCM shall request the main contactors to be closed (BattTracCnnct\_D\_Rq = 0x1) if the following conditions are true:

1. The Arbitrated Plug Status is “On Plug” (PlgActvArb\_B\_Actl = 0x1)

AND

1. The Charger Input Power Mode is “DC Charging” (ChrgrInPwMde\_D\_Actl = 0x5)

AND

1. The BECM Charge Status is “Charge Ready” or “Charging” (BattChrgRdyStat\_D\_Actl = 0x2, 0x3)

*Notes/Rationale*

*DC Fast Charging requires both the Main Positive and Main Negative contactors to be closed. The BECM cannot close the Main Negative Contactor without a request from the HPCM, as it will provide power to the traction bus. As such, when the vehicle is in a DC Charge mode and is ready to charge, the HPCM must request the contactors to be closed.*

### ~~DR-REQ-323500/A-DCFC Count for Display~~

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC Count for Display** | **ID**  DR-REQ-323500 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

~~The BECM shall calculate and store the number of times the high voltage battery is charged using DC Fast Charging. The BECM shall transmit this count for display to the customer using signal TBD.~~

~~Signal Definition:~~

~~TBD~~

*~~Rationale/Notes:~~*

*~~Too many DCFC events can cause the high voltage battery to degrade faster than normally expected. The number of DCFC events should be easily accessible by the customer to inform them of their DCFC habits. See BECM IFS for details on how to determine if a DCFC occurred.~~*

### ~~DR-REQ-323501/A-DCFC Count - APIM Display~~

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC Count - APIM Display** | **ID**  DR-REQ-323501 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To** | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

~~The APIM/Cluster shall display the number of times DCFC has been used to charge the high voltage battery according to SIGNAL TBD~~

# PIC System Design Diagram (PIC SDD) (200545; A)

A diagram of the Controls and HW Functions that the HLF utilizes to achieve the overall function. Includes the relationships between the functions. Ties directly to the higher level boundary (HLF BD).

## Plant (200540; A)

## Control (200541; A)

# PIC Derived Requirements (PIC DRs) By Sub-system (200548; A)

# HLFR\_PIC\_DRs\_to\_SSFT16\_Electrified\_Vehicle\_Controls

## DR-REQ-140520/B-Torque Not Available While on Plug

|  |  |  |
| --- | --- | --- |
| **Title**  **Torque Not Available While on Plug** | **ID**  DR-REQ-140520 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links**  DR-REQ-326489/A-VMP Shutdown for preventing wheel torque on MHT[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=y1XtIF4ax3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**Torque Not Available While on Plug**

The VSC shall prevent Torque to the wheels if:

1. The vehicle is plugged in (PlgActvArb\_B\_Actl = ON PLUG)

AND

1. The vehicle speed is less than 5 mph (calibratable)

*Rationale/Notes*

*Raw plug status is determined by PlgActv\_D\_ActlChrgr. If raw plug status is faulted, use the arbitrated plug status PlgActvArb\_B\_Actl, determined by the logic in DR-REQ-140557.*

*~~NA customers are adverse to their vehicle being disabled an assailant approaching their vehicle and disabling it while they are in Drive, thus the vehicle is required to be in Park before disabling torque.~~ Per FMVSS 305, this may not be true. Ford has asked NHTSA for clarification on if they can wait until the vehicle is in Park before disabling torque. Until then, Ford vehicles in NA will follow the same regulation strategy as EU and China.*

*EU and China regulatory requirements require only that the vehicle speed is guaranteed to be below a threshold so that torque is not disabled while the vehicle is in motion.*

*The table below is for if NHTSA’s response allows Ford to wait until Gear Position is Park for NA.*

|  |  |  |  |
| --- | --- | --- | --- |
| ***Entry Condition*** | ***North America*** | ***Europe*** | ***China*** |
| *Gear = P* | *X* |  |  |
| *Speed <5mph (calibratable)* |  | *X* | *X* |

*For North America, the regulation is captured under FMVSS 305 S5.4.6.3. The text reads:*

*“If the on-board electric energy storage device can be externally charged, vehicle movement of more than 150 mm by its own propulsion system shall not be possible as long as the charge connector of the external electric power supply is physically connected to the vehicle charge inlet in a manner that would permit charging of the electric energy storage device.”*

*For Europe, the regulation is in R100 S5.3 and reads:*

*“If the on-board REESS can be externally charged by the user, vehicle movement by its own propulsion system shall be impossible as long as the connector of the external electric power supply is physically connected to the vehicle inlet. This requirement shall be demonstrated by using the connector specified by the car manufacturer.”*

*For China, there are two sections related to preventing propulsion. The first is GBT19571 S4.2.1.2 and reads:*

*“For the vehicles supplied with outside recharging devices, when the vehicles are connected to the outside circuits (i.e. power line, outside charger), the vehicle shall not be moved by its self-driving system.”*

*The second is GBT18384.2 S4.2 and reads:*

*“If the on-board REESS of the vehicle propulsion system can be charged via an off-board power source, when the user physically connects the vehicle to the off-board electric power supply, vehicle motion by its own propulsion system shall be impossible.”*

### DR-REQ-326489/A-VMP Shutdown for preventing wheel torque on MHT

|  |  |  |
| --- | --- | --- |
| **Title**  **VMP Shutdown for preventing wheel torque on MHT** | **ID**  DR-REQ-326489 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140520/B-Torque Not Available While on Plug[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SddpYTeZx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The VSC shall transition to a “shutdown” state if the following conditions are true:

1. The vehicle is not in Park (GearLvrPos\_D\_Actl != 0x0)

AND

1. The vehicle is on plug (PlgActvArb\_B\_Aclt = 0x1)

AND

1. Vehicle speed is below 5 kph (calibratable)

The VSC shall ignore start up requests while the following conditions are true:

1. The vehicle is not in Park (GearLvrPos\_D\_Actl != 0x0)

AND

1. The vehicle is on plug (PlgActvArb\_B\_Aclt = 0x1)

*Rationale/Notes*

*The HEV system controller does not have control over wheel torque in MHT configured vehicles. As such, it is possible for the HEV controller to be in a Torque disabled state, but for wheel torque to still be possible while on plug, which will violate DR-REQ-140520 and FMVSS 305.*

*Placing the vehicle into a shut down state when on plug and not in Park allows the vehicle to meet FMVSS requirements within the capability of the HEV system controller. If the driver shifts, to Park, the VSC can allow power up requests again, as the BTSI will prevent the vehicle from being able to move, and it will give the customer power for auxiliary systems, such as climate control.*

## DR-REQ-140557/C-Plug Status Override

|  |  |  |
| --- | --- | --- |
| **Title**  **Plug Status Override** | **ID**  DR-REQ-140557 | **Revision**  C  **Status** |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links**  DR-REQ-140562/B-Is the Vehicle Plugged In Command[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SgR1wlK6x3NrTD)]  DR-REQ-140559/A-Cluster Message - Plug Override[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=h3cVRD6_x3NrTD)]  DR-REQ-413897/A-Plug Override Recovery[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=DlnB38H7x3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**Plug Status Override**

If the raw plug status is Missing, Unknown, or Faulted (PlgActv\_D\_ActlChrgr = 0x2 or 0x3), and a vehicle start is requested the VSC shall send an override request to the cluster (ChkPlgToStrt\_D\_Dsply). The VSC shall override the plug status based on feedback from the customer via the cluster (PlgOvrrdStrt\_D\_Cmd), according to the flow diagram and state table below:

See control flow below.



**State Table for PCM/HPCM plug status as follows:**

|  |  |  |
| --- | --- | --- |
| Inputs To PCM  X = Don't Care | | Outputs From  PCM |
| PlgActv\_D\_ActlChrgr | PlgOvrrdStrt\_D\_Cmd | PlgActvArb\_B\_Actl |
| 0x1: On Plug | X | ON Plug |
| 0x0: Off Plug | X | OFF Plug |
| Missing | Customer Confirms OFF Plug | OFF Plug |
| Missing | Customer Indicates ON Plug | ON Plug |
| Missing | No Response  (Null State, Missing or Invalid) | ON Plug |
| 0x3: Fault | Customer Confirms OFF Plug | OFF Plug |
| 0x3: Fault | Customer Indicates ON Plug | ON Plug |
| 0x3: Fault | No Response  (Null State, Missing or Invalid) | ON Plug |
| 0x2: Unknown | Customer Confirms OFF Plug | OFF Plug |
| 0x2: Unknown | Customer Indicates ON Plug | ON Plug |
| 0x2: Unknown | No Response  (Null State, Missing or Invalid) | ON Plug |

Signal Definition

Signal Name: PlgActvArb\_B\_Actl

Size: 1 bits

Values:

* 0x0 – Off Plug
* 0x1 – On Plug

Resolution: Bool

Rate: 100 msec

Tx: HPCM/PCM

Rx: IPC, BCM

*Rationale/Notes:*

*It is desired to find a way to transition into a vehicle mode which doesn't require a key-off before next start request. Intended function is that the vehicle could transitions into PwPckOn\_TqNotAvailable, then wait for the next vehicle start request.*

*Propose details of this be added to PUPD. This was discussed with the PHEV charge system team and there are multiple checks to determine on plug and it was recommended this only apply to missing or faulted plug status.*

*Inputs:*

* *PlgActv\_D\_ActlChrgr*
* *PlgOvrrdStrt\_D\_Cmd*

*Output*

* *PlgActvArb\_B\_Actl*

*Suggest HPCM/PCM initialize PlgActvArb\_B\_Actl to on plug to avoid any potential issues with late or missing plug status from the charger.*

### DR-REQ-140562/B-Is the Vehicle Plugged In Command

|  |  |  |
| --- | --- | --- |
| **Title**  **Is the Vehicle Plugged In Command** | **ID**  DR-REQ-140562 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140557/C-Plug Status Override[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TQuB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Request Plug Status Override**

The VSC shall send a message to the cluster requesting the Plug Status Override display when

* The raw plug status is Faulty or Unknown(PlgActv\_D\_ActlChrgr = 0x2, 0x3)

AND

* A Vehicle Start is requested

Signal Definition

Signal Name: ChkPlgtoStrt\_D\_Dsply

Size: 2 bits

Values:

* 0x0 – No Message Display
* 0x1 – Check Plug to Start
* 0x2 – Is vehicle unplugged prompt
* 0x3 – Not used

Resolution: Discrete

Rate: 100 msec

Tx: HPCM

Rx: IPC

### DR-REQ-140559/A-Cluster Message - Plug Override

|  |  |  |
| --- | --- | --- |
| **Title**  **Cluster Message - Plug Override** | **ID**  DR-REQ-140559 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140557/C-Plug Status Override[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TQuB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Cluster Message – Plug Override**

The instrument cluster shall display a message and provide a feedback option to the customer that enables the customer to confirm the vehicle is unplugged from the wall based on the VSC input. The cluster will send the feedback in the Plug Override Start Command signal to the HPCM.

This signal shall include the following states:

* Null State (no customer response)
* Customer response indicating the vehicle is plugged in (don't over-ride plug status)
* Customer response indicating the vehicle is not plugged in (over-ride plug status)

Signal Definition

Signal Name: PlgOvrrdStrt\_D\_Cmd

Size: 2 bits

Values:

* 0x0 – Null
* 0x1 – Don’t Override Plug Status
* 0x2 – Override Plug Status
* 0x3 – Not used

Resolution: Discrete

Rate: 1000 msec EP

Tx: IPC

Rx: HPCM

### DR-REQ-413897/A-Plug Override Recovery

|  |  |  |
| --- | --- | --- |
| **Title**  **Plug Override Recovery** | **ID**  DR-REQ-413897 | **Revision**  A  **Status** |
| **Meets** | | |
| **Applies To** | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140557/C-Plug Status Override[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TQuB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the VSC is overriding the plug status and the raw plug status changes to a non-faulted value, the VSC shall stop overriding the plug status and change the arbitrated plug status to reflect the raw value.

*Rationale/Notes*

*Raw Plug Status: PlgActv\_D\_ActlChrgr*

*Arbitrated Plug Status: PlgActvArb\_B\_Actl*

*Plug override is a failure mode case. If the failure is resolved (in this case, the raw plug status changes to On Plug or Off Plug) then the vehicle should recover from the failure case and follow the raw status.*

## DR-REQ-242077/A-DC Fast Charge Inhibit Override

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge Inhibit Override** | **ID**  DR-REQ-242077 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-209498/C-DC Fast Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iMf1lqrFx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DC Fast Charge inhibit Override**

If the Charge Power Mode is either “Digital Comm Detected” or “DC Charging” (ChrgrInPwMde\_D\_Actl = 0x2 OR 0x5), then the VSC shall set the charge inhibit flag to “Enable Charging” (BattChrgInhibt\_D\_Rq = 0x0)

*Rationale/Notes*

*The VSC should ignore value charge windows if the vehicle is plugged into a DC fast charger – it is expected that the customer wants the vehicle to charge immediately*

*If the EVSE is a Digital AC charger, this allows the HPCM to first override the inhibit, then bring it back if necessary when ChrgrInPwMde\_D\_Actl changes to “AC Digital”*

## DR-REQ-328645/A-DTC - Driving on plug

|  |  |  |
| --- | --- | --- |
| **Title**  **DTC - Driving on plug** | **ID**  DR-REQ-328645 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The VSC shall set a DTC for driving while on plug if the following conditions are true:

1. The vehicle is on plug (PlugActvArb\_B\_Actl = 0x1)

AND

1. The vehicle speed is above a calibratable threshold for a calibratable amount of time
   1. Default cals: above 3.2 kph for 1 second

*Rationale/Notes*

## DR-REQ-309265/A-External Charge Fault Display

|  |  |  |
| --- | --- | --- |
| **Title**  **External Charge Fault Display** | **ID**  DR-REQ-309265 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Charger Input Power Mode is “EVSE Faulty” (ChrgrInPwMde\_D\_Actl = 0x8), the VSC shall set the External Charger Fault Display Signal to “Yes” (ExtChrgrFalt\_B\_Dsply = 0x1) until:

1. The vehicle key state changes from “On” to “Off”.

OR

1. The arbitrated plug status (PlgActvArb\_B\_Actl) changes from OFF PLUG (0x0) to ON PLUG (0x1)

Signal Definition

Signal Name: ExtChrgrFalt\_B\_Dsply

Size: 1 bit

Values:

* 0x0 – No
* 0x1 – Yes

Resolution: Discrete

Rate: 1000 msec

Tx: HPCM

Rx: IPC

*Notes/Rationale:*

*Normally, ChrgStat\_D2\_Dsply would be set to EVSE Fault. However, ChrgStat\_D2\_Dsply cannot latch the Faulty state if the vehicle is unplugged – thus, the customer would not get the pop up saying their EVSE was faulted, and it may result in TGW’s incorrectly assigned to the charging system as the vehicle did not charge.*

*The cluster will instead display the popup based on ExtChrgrFalt\_B\_Dsply. A separate signal allows the HPCM to latch the faulty value until the next key off, so the customer can see their popup without any change to ChrgStat\_D2\_Dsply. ChrgStatD2\_Dsply will still be used to communicate EVSE Fault status to the APIM and TCU. As such, the status of the external charge fault needs to be stored in KAM until the vehicle keys on then keys off again.*

*If, however, the plug status changes from OFF PLUG to ON PLUG, the BCCM will re-evaluate the EVSE status. It is possible that a new, non faulted EVSE is plugged in, and the HPCM should clear the fault flag and wait for a new ChrgrInPwMde\_D\_Actl from the BCCM.*

### DR-REQ-271049/B-EVSE Faulty - Cluster Notification

|  |  |  |
| --- | --- | --- |
| **Title**  **EVSE Faulty - Cluster Notification** | **ID**  DR-REQ-271049 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-137808/C-Types of Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i8QxmyXVx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

When the External Charge Fault Display signal is “Yes” (ExtChrgrFalt\_B\_Dsply = 0x1), and the vehicle is keyed on into Accessory or Run mode, the cluster shall display a popup notification to the cluster indicating that there was an external charge station fault.

*Rationale/Notes*

*The cluster serves as a way of notifying the customer of a faulted EVSE, but the customer must turn the vehicle on to see it.*

*The CSI will also display a unique External Fault LED pattern to give the customer an initial indication of the problem. See CSI HLF for details.*

## DR-REQ-312181/B-DC Fast Charge Open Contactor Request for HPCM

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge Open Contactor Request for HPCM** | **ID**  DR-REQ-312181 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The HPCM shall request the main contactors to be open (BattTracCnnct\_D\_Rq = 0x0) if the following conditions are true:

1. The Arbitrated Plug Status is “On Plug” (PlgActvArb\_B\_Actl = 0x1)

AND

1. The Charger Input Power Mode is “DC Charging” (ChrgrInPwMde\_D\_Actl = 0x5)

AND

1. The BECM Charge Status is “Charge Wait” (BattChrgRdyStat\_D\_Actl = 0x1)

AND

1. The DC Charge Status is “GBTPrecharge” (DcChrgRdy\_D\_Stat = 0x7)

AND

1. The vehicle speed is less than 5 mph (calibratable)

*Notes/Rationale*

*The DC Charge Sequence requires the main negative contactor to open in order to discharge the bus and pre charge for DC Fast Charging. This may require the HPCM to power down the vehicle in order to open the contactors and discharge – see Power Up Power Down HLF.*

*The HPCM should do this only just before the Precharge step in the China DC Fast Charge sequence. Since the whole sequence can take up to four minutes, and the HV accessories are not available while the main contactors are open, waiting for Precharge will result in the least impact to the HV accessory availability.*

*For NA and EU, the main contactors will remain closed for the duration of the contactor sequence.*

## DR-REQ-313715/A-DC Fast Charge - HPCM Close Contactor

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge - HPCM Close Contactor** | **ID**  DR-REQ-313715 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 16\_Electrified Vehicle Controls | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The HPCM shall request the main contactors to be closed (BattTracCnnct\_D\_Rq = 0x1) if the following conditions are true:

1. The Arbitrated Plug Status is “On Plug” (PlgActvArb\_B\_Actl = 0x1)

AND

1. The Charger Input Power Mode is “DC Charging” (ChrgrInPwMde\_D\_Actl = 0x5)

AND

1. The BECM Charge Status is “Charge Ready” or “Charging” (BattChrgRdyStat\_D\_Actl = 0x2, 0x3)

*Notes/Rationale*

*DC Fast Charging requires both the Main Positive and Main Negative contactors to be closed. The BECM cannot close the Main Negative Contactor without a request from the HPCM, as it will provide power to the traction bus. As such, when the vehicle is in a DC Charge mode and is ready to charge, the HPCM must request the contactors to be closed.*

# HLFR\_PIC\_DRs\_To\_Traction\_Battery\_Controls

## DR-REQ-207319/A-Battery State of Charge Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **Battery State of Charge Signal** | **ID**  DR-REQ-207319 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137812/A-State of Charge Definition[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xyWVw6x1x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Battery State of Charge Signal**

The BECM shall calculate the true battery state of charge as a percent of total available battery energy and broadcast it on the CAN bus.

Signal Definition

Signal Name: BattTracSoc2\_Pc\_Actl

Size: 14 bits

Range: 0-163.81 %

Resolution: 0.01 %

0xFFE – No Data Exists

0xFFF – Faulty

Rate: 100 msec

Tx: BECM

Rx: HPCM, TCU, PCM, ECM

## DR-REQ-207320/B-Customer State Of Charge Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **Customer State Of Charge Signal** | **ID**  DR-REQ-207320 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137812/A-State of Charge Definition[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xyWVw6x1x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall calculate the customer state of charge as a percent of battery energy available for driving and broadcast it onto the CAN bus.

Signal Definition

Signal Name: BattTracSoc\_Pc\_Dsply

Size: 8 bits

Range: 0-126.5 %

Resolution: 0.5 %

0xFE – No Data Exists

0xFF – Faulty

Rate: 100 msec

Tx: BECM

Rx: BCCM, IPC, APIM, DCGM, TCU, HPCM, PCM, ECM

**Rationale/Notes**

*CSoC is the state of charge that is seen by the customer, and it represents the energy used for driving. In PHEVs, this is the portion of the battery used for Charge Deplete Mode, and it should be 0% when the customer enters Charge Sustain Mode.*

### DR-REQ-328367/A-CSoC at Charge Complete

|  |  |  |
| --- | --- | --- |
| **Title**  **CSoC at Charge Complete** | **ID**  DR-REQ-328367 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

While the vehicle is charging, the BECM shall set the CSoC (BattTracSoc\_Pc\_Dsply) to a value less than 100%. The BECM shall set CSoC to 100% when it declares “Charge Complete” (BattChrgRdyStat\_D\_Actl = 0x4)

*Notes/Rationale*

*Normally, the BECM rounds the CSoC to the nearest integer value. However, in the constant voltage portion of charging (near top of charge), it can to take up to 20 minutes to get from 99% to “Charge Complete”. During this time, it is best to hold CSoC at 99% instead of rounding to the nearest integer and reaching 100% before the BECM declares charge complete.*

## DR-REQ-242070/B-BECM Charge Wait

|  |  |  |
| --- | --- | --- |
| **Title**  **BECM Charge Wait** | **ID**  DR-REQ-242070 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**BECM Charge Wait**

The BECM shall transition to “Charge Wait” when the following system conditions are true:

1. The HPCM Charge Inhibit status is NOT “Inhibit Charging” (BattChrgInhbt\_D\_Rq != 0x01)

AND

1. The Charger Mode is Digital Comm Detected, AC Basic, AC Digital, DC Charge, or Inductive Charging (ChrgrInPwMde\_D\_Actl = 0x2, 0x3, 0x4, 0x5, 0x6)

AND

1. Either
   1. Battery needs charging (SOC <98% calibratable) AND the HPCM Charge Inhibit status is NOT “Maintain Target SoC” (BattChrgInhbt\_D\_Rq !- 0x03)

OR

* 1. The low voltage support is required (ULoSrcOnPlg\_B\_Cmd = 0x1)

OR

* 1. The contactors are requested closed (BattTracCnnct\_D\_Rq = 0x1) AND the contactors are closed (BattTracCnnct\_D\_Cmd = 0x1)

AND

1. The Charger Ready Status is NOT “ChargerFault” (ChrgrRdyStat\_D\_Actl !=0x2)

AND

1. The BECM is ready to transfer to “Charge Wait”

AND

1. An HEV wake has occurred within a calibratable time span.

**Rationale/Notes**

*The Charge Inhibit flag from the HPCM is used to hold off charging until a value charge window has been reached.*

## DR-REQ-214922/B-BECM Charge Ready

|  |  |  |
| --- | --- | --- |
| **Title**  **BECM Charge Ready** | **ID**  DR-REQ-214922 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall transmit “Charge Ready” when the following system conditions are true:

1. The HV battery has not exceeded a calibratable SoC threshold for this charge cycle.

AND

1. The BCCM Charge Ready status (ChrgrRdyStat\_D\_Actl = 0x1) is “Charger Ready”

AND

1. The Charger CPE is “Enabled” (ChrgrCnnctPwr\_B\_Stat = 0x1)

AND

1. The BECM is ready to transition to “Charge Ready”

*Rationale/Note*

*These requirements are from a system level only – the BECM may have additional internal parameters that prevent it from transitioning to “Charge Ready” even if all of the above conditions are met.*

*The first condition is meant to prevent the BECM from constantly initiating charge sequence due to SoC bleed off or preconditioning. SR-REQ-137810 covers the situations in which this condition can be overruled.*

## DR-REQ-235773/A-BECM Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **BECM Charging** | **ID**  DR-REQ-235773 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall transition to “Charging” when the following system conditions are true:

1. The BCCM charge status is “Charge Ready” (ChrgrRdyStat\_D\_Actl = 0x1)

AND

1. The BECM charge status is “Charge Ready” (BattChrgRdyStat\_D\_Actl = 0x2)

AND

1. Precharge sequence has been completed

AND

1. The BECM is ready to transition to “Charging”

## DR-REQ-271257/A-FMEM - BCCM Fault

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - BCCM Fault** | **ID**  DR-REQ-271257 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the BCCM status message is missing or "Faulty" (ChrgrRdyStat\_D\_Actl = 0x2), the BECM will stop charging and go to "Not Ready" (BattChrgRdyStat\_D\_Actl = 0x0).

## DR-REQ-271260/A-FMEM - Charge Inhibit Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Charge Inhibit Signal** | **ID**  DR-REQ-271260 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Charge Inhibit Signal is missing (BattChrgInhbt\_D\_Rq) and HEV wake is high, the BECM should treat the signal as “Enable\_Charging” (BattChrgInhbt\_D\_Rq = 0x0).

If the Charge Inhibit Signal is missing (BattChrgInhbt\_D\_Rq) and HEV wake is low, the BECM should treat the signal as its last known value.

*Rationale/Notes*

*Since the HPCM is off for the majority of charging, the BECM should assume last known value if the signal is missing.*

*If the inhibit signal is missing, the BECM should assume that charging is allowed. While this is counterintuitive with the FMEM strategies for Gear Position and Torque Status (which assume the value that does not allow charging), from a system perspective this is acceptable. Future programs may have the Inhibit signal originate from a difference source, in which case this distinction will be important.*

## DR-REQ-271261/A-FMEM - Charger Ready Status

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Charger Ready Status** | **ID**  DR-REQ-271261 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the charger ready status (ChrgrRdyStat\_D\_Actl) is missing, the BECM will treat the signal as "Faulted" (ChrgrRdyStat\_D\_Actl = 0x2).

*Rationale/Notes*

*The BECM should treat a missing charger ready status as faulted in order to avoid and infinite loop that sends a sustain to the whole HEV wake line.*

## DR-REQ-344077/A-FMEM - EVSE Status Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - EVSE Status Signal** | **ID**  DR-REQ-344077 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission FHEV [MHT\_FHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the EVSE Status (ChrgrInPwMde\_D\_Actl) is missing, the BECM will treat the signal as "EVSE Not Detected" (ChrgrInPwMde\_D\_Actl = 0x0).

*Rationale/Notes*

*The BECM should treat a missing EVSE status signal as “EVSE Not Detected” in order to avoid a loop that will cause the BECM to cycle between Not Ready and Charge Wait and issue wakeups indefinitely.*

## DR-REQ-193867/D-BECM Event Wakeups

|  |  |  |
| --- | --- | --- |
| **Title**  **BECM Event Wakeups** | **ID**  DR-REQ-193867 | **Revision**  D  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links**  DR-REQ-261943/B-Charge Target Reached Event Wakeup[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CQcx6XIzx3NrTD)]  DR-REQ-262123/D-Charge Requested CAN Sustain[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=jIV91TkWx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall assert the HEV\_Wakeup hardline under any of the following conditions:

1. Any transition between any battery heating or cooling mode

OR

DCDC OR BCCM require max cooling (HPCM will ignore on non e-RAD vehicles) (*BattTracTeEvnt\_B\_Stat is sent as TRUE*).

1. When the charge target is reached. If no target is set, charge complete shall be used (*BattChrgTrgtEvnt\_B\_Stat is sent as TRUE*).
2. ~~Initiating Active Cabin Venting~~

*Note:*

1. *See battery thermal HLF for conditions. Decided to include transitions into cooling mode 0 (off) for simplicity and to allow the HPCM to set a required proportional valve state.*

### DR-REQ-261943/B-Charge Target Reached Event Wakeup

|  |  |  |
| --- | --- | --- |
| **Title**  **Charge Target Reached Event Wakeup** | **ID**  DR-REQ-261943 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-193867/D-BECM Event Wakeups[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ipVtROnMx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall drive the HEV\_Wake hardline high and send the Charge Target Reached Event Wakeup CAN Signal (*BattChrgTrgtEvnt\_B\_Stat*) as TRUE:

* When the customer SoC has reached or exceeded the target SoC (BattTracSoc\_Pc\_Dsply = BattChrgTrgtSoC\_D\_Rq OR BattTracSoc\_Pc\_Dsply = CurntTrgtSoc\_Pc\_Rq)

OR

* The BECM has transitioned to “Charge Complete” (BattChrgRdyStat\_D\_Actl = 0x4)

*Note: Charge Complete means you have reached 100%. Charge Target can be less than 100%*

*CurntTrgtSoc\_Pc\_Actl will begin being used with MY21 CX727.*

### DR-REQ-262123/D-Charge Requested CAN Sustain

|  |  |  |
| --- | --- | --- |
| **Title**  **Charge Requested CAN Sustain** | **ID**  DR-REQ-262123 | **Revision**  D  **Status** |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-193867/D-BECM Event Wakeups[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ipVtROnMx3NrTD)]  DR-REQ-193374/B-BECM CAN Sustain Conditions[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=hrWdtm3Yx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall issue the Charge Requested CAN Sustain Wakeup, BattTracChrgSustn\_B\_Rq = 0x1 Active when the following conditions are met:

1. BattChrgInhbt\_D2\_Rq = 0x0: Enable Charging OR 0x3 MaintainTargetSoc OR 0x2 EndAtTarget

AND

1. ChrgrInPwMde\_D\_Actl= 0x2: DigitalCommDetected OR 0x3: AC Basic OR 0x4: AC Digital OR 0x5: DC Charging OR 0x6 IC Charging

AND

1. Either
   1. Battery needs charging (SOC <98% calibratable)

OR

* 1. The low voltage support is required (ULoSrcOnPlg\_B\_Cmd = 0x1)

OR

* 1. The contactors are requested closed (BattTracCnnct\_D\_Rq = 0x1) AND the contactors are closed (BattTracCnnct\_D\_Cmd = 0x1)

AND

1. ChrgrRdyStat\_D\_Actl = 0x0: Not Ready OR 0x1: Charge Ready OR 0x3: Charging.

AND

1. The HEV Wake is set to HIGH

The sustain shall be issued to the following modules:

* BCM
* PCM
* DCDC
* BCCM
* BCMC (CAN PDB)

The BECM shall drop the Charge Requested CAN Sustain Wakeup (BattTracChrgSustn\_B\_Rq = 0x0) when it is in the “Not Ready” or “Faulted” State (BattChrgRdyStat\_D\_Actl = 0x0 or 0x5) and it has completed all contactor logic related to charging.

*Notes:*

*Charge Permitted’ is a replacement for Charge Inhibit, to prevent cycling of contactors during value charging.*

*Charge Requested not only serves to sustain modules for charging, but an indication to the HPCM that the BECM recognized its request for charge.*

*HEV wake is required to set the CAN sustain, but it is not required to hold the CAN sustain. This will help avoid a loop where the sustain is always sent even if other components (like the BCCM) are not ready to charge, but the BECM can recover and send the sustain again and attempt to start charging if the HEV wake is HIGH again.*

*The BECM needs to hold the CAN sustain for as long as it needs other modules to perform functions related to charging or completing charging. Since the BCCM sends the CPE to allow the contactors to be cycled, the BECM needs to keep the BCCM awake after completing charging in order to perform a weld check (if needed).*

### DR-REQ-314690/C-DC Charge Requested CAN Sustain

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Charge Requested CAN Sustain** | **ID**  DR-REQ-314690 | **Revision**  C  **Status** |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall issue the DC Charge Requested CAN Sustain Wakeup, BattTracDcChrgSustn\_B\_Rq = 0x1 Active when the following conditions are met:

1. BattChrgInhbt\_D2\_Rq = 0x0: Enable Charging OR 0x3 MaintainTargetSoc OR 0x2 EndAtTarget

AND

1. ChrgrInPwMde\_D\_Actl= 0x2: DigitalCommDetected OR 0x5: DC Charging

AND

1. Battery needs charging (SOC <98% calibratable)

AND

1. ChrgrRdyStat\_D\_Actl = 0x0: Not Ready OR 0x1: Charge Ready OR 0x3: Charging.

AND

1. The HEV Wake is set to HIGH

The sustain shall be issued to the following modules:

* HPCM

The BECM shall drop the DC Charge Requested CAN Sustain Wakeup (BattTracDcChrgSustn\_B\_Rq = 0x1) when it has entered the “Not Ready” or “Faulty” state (BattChrgRdyStat\_D\_Actl = 0x0 or 0x5) and it has completed all contactor logic related to DC charging.

*Notes:*

*DC Charging requires the HPCM to be awake in order to send the contactor close request. Since HPCM is not awake during normal charging, it cannot use the AC Charging Sustain (BattTracChrgSustn\_B\_Rq) and so a new, DC Charging specific sustain is required.*

*Charge Permitted’ is a replacement for Charge Inhibit, to prevent cycling of contactors during value charging.*

*Charge Requested not only serves to sustain modules for charging, but an indication to the HPCM that the BECM recognized its request for charge.*

*HEV wake is required to set the CAN sustain, but it is not required to hold the CAN sustain. This will help avoid a loop where the sustain is always sent even if other components (like the BCCM) are not ready to charge, but the BECM can recover and send the sustain again and attempt to start charging if the HEV wake is HIGH again.*

*The BECM needs to hold the CAN sustain for as long as it needs other modules to perform functions related to charging or completing charging. Since the BCCM sends the CPE to allow the contactors to be cycled, the BECM needs to keep the BCCM awake after completing charging in order to perform a weld check (if needed).*

## DR-REQ-238478/A-Hold-Off after Charge Complete

|  |  |  |
| --- | --- | --- |
| **Title**  **Hold-Off after Charge Complete** | **ID**  DR-REQ-238478 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137810/A-Hold-Off Charging after Charge Complete[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=h_WVw6x1x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Hold-Off Charging after Charge Complete**

The BECM shall not be permitted to re-enter HV charging after completing a charge unless the following conditions are true:

* All system conditions defined in SR-REQ-137806 are true

AND

* + Plug Status (PlgActv\_D\_ActlChrgr) has transitioned from ON PLUG to OFF PLUG and back to ON PLUG (i.e. the plug has been re-inserted)

OR

* + The vehicle key state (Ignition\_Status) has transitioned from OFF(0x1) to RUN (0x4)

OR

* + BSOC drops below a calibratable hysteresis of the target SoC (BattChrgTrgtSoC\_Pc\_Rq)

OR

* + 12V Battery Support is requested (ULoSrcOnPlg\_B\_Cmd = 1)(See DR-REQ-XXXXX)

*Rationale/Notes*

*There are some conditions under which the contactors need to close after charge is complete.*

*Any time there is a change in plug status, the charging system must re-evaluate it’s need for charging*

*If the vehicle is keyed on, even while on plug, contactors must close to turn on the vehicle.*

*If the BSoC ever falls too low, charging must re-initiate to charge back up to 100% (or the requested target)*

*The case of thermal conditioning being requested is covered by the above hysteresis – if the thermal conditioning system (cabin or battery) brings the SoC below the threshold, the BECM will re-initiate charging and maintain the targeted SoC*

*The 12V systems needs to close contactors to keep the 12V battery alive every 24 hours. The contactors must close during this time to charge the 12V battery.*

*All other system conditions (PRNDL in Park, HPCM is not inhibiting, BECM and BCCM are OK to charge) must still be true as defined in the Conditions for Charging SR. It is assumed that the Charge Inhibit flag from the HPCM will be either be “allow charging” or “Maintain target SoC” after charge complete is reached in order to allow the contactors to close for any of the above situations.*

## DR-REQ-271263/A-FMEM - Charge Target Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Charge Target Signal** | **ID**  DR-REQ-271263 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137810/A-Hold-Off Charging after Charge Complete[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=h_WVw6x1x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Charge Target Signal is Missing (BattChrgTrgtSoC\_Pc\_Rq), the BECM shall assume the target as the last known value.

*Rationale/Notes*

*Since the HPCM will be asleep for most of a charge event, the BECM should treat a missing Charge Target Signal as the last known value.*

## DR-REQ-242074/A-DCFC BECM Charge Wait

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC BECM Charge Wait** | **ID**  DR-REQ-242074 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC BECM Charge Wait**

The BECM shall transition to “Charge Wait” when the following system conditions are true:

1. The HPCM Charge Inhibit status is NOT “Inhibit Charging” (BattChrgInhbt\_D\_Rq != 0x01)

AND

1. The Charge Mode is “Digital Comm Detected” (ChrgrInPwMde\_D\_Actl =0x2) or “DC Charge (ChrgrInPwMde\_D\_Actl = 0x05)

AND

1. The SOC is below a calibratable Charge Threshold (BattTracSoC\_Pc\_Actl < 98%; calibratable)

AND

1. The BECM is ready to transition to “Charge Wait”

**Rationale/Notes**

*HPCM will never send “Inhibit Charging” if the charge mode is Digital Comm Detected or DC Charging.*

*DC Charging should only begin when the vehicle is below an SOC that will allow DC charging. Otherwise, the system should default to AC Digital Charging.*

## DR-REQ-242124/A-DCFC BECM Charge Ready

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC BECM Charge Ready** | **ID**  DR-REQ-242124 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC BECM Charge Ready**

The BECM shall not transition to “Charge Ready” unless the following System Conditions are true:

1. The DCGM Charge Status is “PreCharge” (DcChrgRdy\_D\_Stat = 0x4) (NA &EU)

OR

The DCGM Charge Status is “GBTPreCharge” (DcChrgRdy\_D\_Stat = 0x7) (CH)

AND

1. The BECM is ready to transition to “Charge Ready”

*Rationale/Notes*

*Once the DCGM performs the cable check and is ready to close contactors, the BECM can transition to charge ready and close the DC contactors*

## DR-REQ-242128/B-DCFC BECM Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC BECM Charging** | **ID**  DR-REQ-242128 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC BECM Charging**

The BECM shall transition to “Charging” when the following system conditions are true:

1. The BECM Charge Status is “Charge Ready” (BattChrgRdyStat\_D\_Actl = 0x2)

AND

1. The DC Charge contactors have been closed

AND

1. The DCGM Charge Status is “PreCharge” (DcChrgRdy\_D\_Stat = 0x4) (NA &EU)

OR

The DCGM Charge Status is “GBTPreCharge” (DcChrgRdy\_D\_Stat = 0x7) (CH)

AND

1. The BECM is ready to transition to “Charging”

Upon transitioning to “Charging”, the BECM shall send the voltage and current set points as necessary to charge the traction battery.

*Rationale/Notes*

*The BECM can begin charging the traction battery once the DC contactors are closed.*

## DR-REQ-242121/A-DCFC BECM Isolation Detection Disable

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC BECM Isolation Detection Disable** | **ID**  DR-REQ-242121 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-209498/C-DC Fast Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iMf1lqrFx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC BECM Isolation Detection Disable**

The BECM shall disable isolation detection when

1. The Charge Mode is set to “DC Charging” (ChrgrInPwMde\_D\_Actl = 0x5)

AND

1. The Isolation Detection Disable Request signal is set to “Yes” (BattTracIsoDis\_B\_Rq = 0x1)

*Rationale/Notes*

*Since the DC contacts are directly connected to the battery (i.e. bypasses the main contactors) the isolation detection must be disabled during a DC charge to avoid invalid fault states*

# HLFR\_PIC\_DRs\_To\_Trac\_Batt\_Charger\_Controls

## DR-REQ-140525/A-Inductive Charging Drive Away

|  |  |  |
| --- | --- | --- |
| **Title**  **Inductive Charging Drive Away** | **ID**  DR-REQ-140525 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Inductive Charging Drive Away**

The BCCM shall disable inductive charging if Torque Status (PwPckTq\_D\_Stat) is either Starting in Progress (0x2) or Torque Available (0x3).

*Note: The charger will need to communicate to the IRCM that the customer is trying to drive away and inductive charging will need to be disabled. We need to determine if there is enough time to ensure that inductive charging can be disabled before the vehicle is in motion.*

## DR-REQ-140444/A-Start Charging Requirements

|  |  |  |
| --- | --- | --- |
| **Title**  **Start Charging Requirements** | **ID**  DR-REQ-140444 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links**  DR-REQ-214922/B-BECM Charge Ready[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CkRxJm5Vx3NrTD)]  DR-REQ-271257/A-FMEM - BCCM Fault[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ySTl2oFxx3NrTD)]  DR-REQ-271258/A-FMEM - Torque Status Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CDXl2oFxx3NrTD)]  DR-REQ-214924/B-BCCM Charge Ready[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=yvbpMlh2x3NrTD)]  DR-REQ-271260/A-FMEM - Charge Inhibit Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SrUl2oFxx3NrTD)]  DR-REQ-271261/A-FMEM - Charger Ready Status[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ibXl2oFxx3NrTD)]  DR-REQ-271262/A-FMEM - Battery Charge Ready Status[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=yPZl2oFxx3NrTD)]  DR-REQ-242070/B-BECM Charge Wait[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=JpTp7YiYx3NrTD)]  DR-REQ-271259/B-FMEM - Gear Position Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iiapYTeZx3NrTD)]  DR-REQ-235773/A-BECM Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TNXdtlbXx3NrTD)]  DR-REQ-344077/A-FMEM - EVSE Status Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=jJZxmcJcx3NrTD)]  DR-REQ-271256/A-FMEM - BECM Fault[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iiVl2oFxx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**Start Charging**

The BCCM shall begin charging (ChrgrRdyStat\_D\_Actl = 0x3) if the following conditions are true:

1. The BCCM Charger Ready Status is ‘Ready’ (ChrgrRdyStat\_D\_Actl = 0x1)

And

1. The BECM Battery Charge Ready Status is ‘Charging’ (BattChrgRdyStat\_D\_Actl = 0x3)

And

1. The BECM is requesting a voltage (BattChrg\_U\_Rq > 0)

*Note 1: BCCM will not go to ready if the vehicle is not in ‘Park’.*

*Note 2: Expected that the vehicle will stay at Top of Charge on a BEV unless it falls down below 96.5%.*

### DR-REQ-242070/B-BECM Charge Wait

|  |  |  |
| --- | --- | --- |
| **Title**  **BECM Charge Wait** | **ID**  DR-REQ-242070 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**BECM Charge Wait**

The BECM shall transition to “Charge Wait” when the following system conditions are true:

1. The HPCM Charge Inhibit status is NOT “Inhibit Charging” (BattChrgInhbt\_D\_Rq != 0x01)

AND

1. The Charger Mode is Digital Comm Detected, AC Basic, AC Digital, DC Charge, or Inductive Charging (ChrgrInPwMde\_D\_Actl = 0x2, 0x3, 0x4, 0x5, 0x6)

AND

1. Either
   1. Battery needs charging (SOC <98% calibratable) AND the HPCM Charge Inhibit status is NOT “Maintain Target SoC” (BattChrgInhbt\_D\_Rq !- 0x03)

OR

* 1. The low voltage support is required (ULoSrcOnPlg\_B\_Cmd = 0x1)

OR

* 1. The contactors are requested closed (BattTracCnnct\_D\_Rq = 0x1) AND the contactors are closed (BattTracCnnct\_D\_Cmd = 0x1)

AND

1. The Charger Ready Status is NOT “ChargerFault” (ChrgrRdyStat\_D\_Actl !=0x2)

AND

1. The BECM is ready to transfer to “Charge Wait”

AND

1. An HEV wake has occurred within a calibratable time span.

**Rationale/Notes**

*The Charge Inhibit flag from the HPCM is used to hold off charging until a value charge window has been reached.*

### DR-REQ-214924/B-BCCM Charge Ready

|  |  |  |
| --- | --- | --- |
| **Title**  **BCCM Charge Ready** | **ID**  DR-REQ-214924 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**BCCM Charge Ready**

The BCCM shall transmit “Ready to Charge” when the following system conditions are true:

1. The PCM gear position is in Park (GearLvrPos\_D\_Actl = 0x0)

OR

The PCM gear position is in Neutral (GearLvrPos\_D\_Actl = 0x2) AND the vehicle is in Plant Mode (LifeCycMde\_D\_Actl = 0x1 FACTORY)]

AND

1. The HPCM Power Pack Torque Status is not in a torque producing mode (i.e., PwPckTq\_D\_Stat = 0x0, 0x1, or 0x2)

AND

1. The Battery Charge Ready Status is “Battery Charge Wait” (BattChrgRdyStat\_D\_Actl = 0x1)

AND

1. The cord lock status is “Locked” (ChrgCordLck\_D\_Stat = 0x2) (European vehicles only)

AND

1. The BCCM is ready to transition to “Ready to Charge”

*Notes/Rationale*

*The charge waits for the vehicle to be in Park and not in a torque producing mode before charging. If the vehicle moves and pulls out the charge cord unexpectedly while transferring energy, there is a risk of an arc or weld that could damage the charging system or the vehicle.*

*The requirement for being in Park can be overridden if the vehicle is in Neutral and in Plant Mode. This is to allow the plant to test the charging system while the vehicle is on the manufacturing line, instead of testing at EOL.*

### DR-REQ-214922/B-BECM Charge Ready

|  |  |  |
| --- | --- | --- |
| **Title**  **BECM Charge Ready** | **ID**  DR-REQ-214922 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall transmit “Charge Ready” when the following system conditions are true:

1. The HV battery has not exceeded a calibratable SoC threshold for this charge cycle.

AND

1. The BCCM Charge Ready status (ChrgrRdyStat\_D\_Actl = 0x1) is “Charger Ready”

AND

1. The Charger CPE is “Enabled” (ChrgrCnnctPwr\_B\_Stat = 0x1)

AND

1. The BECM is ready to transition to “Charge Ready”

*Rationale/Note*

*These requirements are from a system level only – the BECM may have additional internal parameters that prevent it from transitioning to “Charge Ready” even if all of the above conditions are met.*

*The first condition is meant to prevent the BECM from constantly initiating charge sequence due to SoC bleed off or preconditioning. SR-REQ-137810 covers the situations in which this condition can be overruled.*

### DR-REQ-235773/A-BECM Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **BECM Charging** | **ID**  DR-REQ-235773 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BECM shall transition to “Charging” when the following system conditions are true:

1. The BCCM charge status is “Charge Ready” (ChrgrRdyStat\_D\_Actl = 0x1)

AND

1. The BECM charge status is “Charge Ready” (BattChrgRdyStat\_D\_Actl = 0x2)

AND

1. Precharge sequence has been completed

AND

1. The BECM is ready to transition to “Charging”

### Charging FMEM Actions (470789; C)

#### DR-REQ-271256/A-FMEM - BECM Fault

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - BECM Fault** | **ID**  DR-REQ-271256 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the BECM status is Missing or "Faulty" (BattChrgRdyStat\_D\_Actl = 0x5), the BCCM will stop charging and go to "Not Ready" (ChrgrRdyStat\_D\_Actl = 0x0).

#### DR-REQ-271257/A-FMEM - BCCM Fault

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - BCCM Fault** | **ID**  DR-REQ-271257 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the BCCM status message is missing or "Faulty" (ChrgrRdyStat\_D\_Actl = 0x2), the BECM will stop charging and go to "Not Ready" (BattChrgRdyStat\_D\_Actl = 0x0).

#### DR-REQ-271258/A-FMEM - Torque Status Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Torque Status Signal** | **ID**  DR-REQ-271258 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Power Pack Torque Status signal (PwPckTq\_D\_Stat) is missing and the HEV Wake line is high, the charger will treat the signal as "Power Pack on Torque Available (PwPckTq\_D\_Stat = 0x3).

If the Power Pack Torque Status signal (PwPckTq\_D\_Stat) is missing and the HEV Wake line is low, the charger will treat the signal as the last assumed value.

*Rationale/Notes*

*If the HEV wake is high, the charger can assume the vehicle is on, and it should assume torque is available and prevent charging for safety.*

*If the HEV wake is low, the last assumed value is the previous value that the charger either received or assumed (if for example HEV wake is high and the signal is missing). This is to avoid a situation where the BCCM sees a missing message, assumes Torque Available and stops charging, but then upon shut down it then assumes Torque not available, wakes up the module, and begins charging, only to go back to assuming torque available. By taking the last assumed state, the charger can safely charge after waking up the HEV powertrain without charging interruption.*

#### DR-REQ-271259/B-FMEM - Gear Position Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Gear Position Signal** | **ID**  DR-REQ-271259 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the gear position signal (GearLvrPos\_D\_Actl) is missing and the HEV Wake is high, the charger should treat the signal as NOT in park (GearLvrPos\_D\_Actl != P).

If the gear position signal (GearLvrPos\_D\_Actl) is missing and the HEV Wake is low, the charger should treat the signal as its last known value.

If the gear position signal is “Unknown” (GearLvrPos\_D\_Actl = 0xE), the charger shall treat the signal as its last known value for 500ms (calibratable). After 500ms (calibratable), the charger shall treat the signal as missing per the above strategy.

If the gear position signal is “Neutral” (GearLvrPos\_D\_Actl = 0x2), the charger shall treat the signal as its last known value for 500ms (calibratable). After 500ms (calibratable), the charger shall treat the signal as its true value.

*Rationale/Notes*

*If the signal is missing and the HEV wake is high, the charger should assume the vehicle could be on or in motion and should not allow charging for safety.*

*If the signal is missing and the HEV wake is low, the charger should assume the vehicle is powered off and can charge if the last known value will allow charging.*

*On some strategies, the gear position signal may be “Neutral” for <100ms when the transmitting module wakes up. The BCCM needs to be robust to these short signal changes to prevent charge interruption. We are currently pursuing a strategy change to make sure this is “Unknown” instead of “Neutral” for future programs. Once this change is made, the requirement to filter “Neutral” will be removed.*

#### DR-REQ-271260/A-FMEM - Charge Inhibit Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Charge Inhibit Signal** | **ID**  DR-REQ-271260 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Charge Inhibit Signal is missing (BattChrgInhbt\_D\_Rq) and HEV wake is high, the BECM should treat the signal as “Enable\_Charging” (BattChrgInhbt\_D\_Rq = 0x0).

If the Charge Inhibit Signal is missing (BattChrgInhbt\_D\_Rq) and HEV wake is low, the BECM should treat the signal as its last known value.

*Rationale/Notes*

*Since the HPCM is off for the majority of charging, the BECM should assume last known value if the signal is missing.*

*If the inhibit signal is missing, the BECM should assume that charging is allowed. While this is counterintuitive with the FMEM strategies for Gear Position and Torque Status (which assume the value that does not allow charging), from a system perspective this is acceptable. Future programs may have the Inhibit signal originate from a difference source, in which case this distinction will be important.*

#### DR-REQ-271261/A-FMEM - Charger Ready Status

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Charger Ready Status** | **ID**  DR-REQ-271261 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the charger ready status (ChrgrRdyStat\_D\_Actl) is missing, the BECM will treat the signal as "Faulted" (ChrgrRdyStat\_D\_Actl = 0x2).

*Rationale/Notes*

*The BECM should treat a missing charger ready status as faulted in order to avoid and infinite loop that sends a sustain to the whole HEV wake line.*

#### DR-REQ-271262/A-FMEM - Battery Charge Ready Status

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Battery Charge Ready Status** | **ID**  DR-REQ-271262 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Battery Charge Ready Status (BattChrgRdyStat\_D\_Actl) is missing, the charger will treat the signal as "Faulted" (BattChrgRdyStat\_D\_Actl = 0x5).

*Rationale/Notes*

*The charge can simply treat a missing BECM charge ready status as “not ready”, allowing it to shut down.*

#### DR-REQ-344077/A-FMEM - EVSE Status Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - EVSE Status Signal** | **ID**  DR-REQ-344077 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission FHEV [MHT\_FHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the EVSE Status (ChrgrInPwMde\_D\_Actl) is missing, the BECM will treat the signal as "EVSE Not Detected" (ChrgrInPwMde\_D\_Actl = 0x0).

*Rationale/Notes*

*The BECM should treat a missing EVSE status signal as “EVSE Not Detected” in order to avoid a loop that will cause the BECM to cycle between Not Ready and Charge Wait and issue wakeups indefinitely.*

#### DR-REQ-346401/A-FMEM - On Board Fault

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - On Board Fault** | **ID**  DR-REQ-346401 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM will set an internal On Board Charging Fault if any of the following system conditions are true:

1. The BECM Charge Status is “Faulted” (BattChrgRdyStat\_D\_Actl = 0x5)

OR

1. The BCCM Charge Status is “Charger Fault” (ChrgrRdyStat\_D\_Actl = 0x2)

OR

1. The DCGM Charge Status is “Faulty” (DcChrgRdy\_D\_Stat = 0xF)

*Rationale/Notes*

*The internal On Board Charging Fault state is used to drive the CSI Display.*

#### DR-REQ-347824/A-FMEM - BECM Timeout

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - BECM Timeout** | **ID**  DR-REQ-347824 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the BECM Charge Status is “Charge Ready”, “Charge Wait”, or “Charge Complete” for more than 35 seconds (calibratable), it will transition to “Not Ready” and set the BECM Charge Sustain to 0.

*Rationale/Notes*

*System conditions may cause the BCCM to remain in a “Not Ready” state when the BECM is in Charge Wait (e.g. the vehicle is not in park). In these cases, the BECM must be able to abort the charge sequence and shut down in order to prevent draining the 12V battery.*

#### DR-REQ-355178/A-FMEM - Charge Target Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Charge Target Signal** | **ID**  DR-REQ-355178 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Charge Target signal (CurntTrgtSoc\_Pc\_Rq) is missing and the HEV Wake line is high, the charger will treat the signal as 100%

If the Charge Target signal (CurntTrgtSoc\_Pc\_Rq) is missing and the HEV Wake line is low, the charger will treat the signal as the last assumed value.

*Rationale/Notes*

*The Charge Target signal drives when the BECM is supposed to send a wakeup to the powertrain so that the PEPC system can inhibit charging based on the customer’s charge target selection.*

*Since the powertrain module may be asleep during charging, the BECM must assume a normal missing signal as the last known value. However, if HEV Wake is high (i.e. the powertrain module is expected to be awake) and the signal is missing, the BECM should default to the maximum value of 100%.*

*See DR-REQ-xxxx in the PEPC HLF for details.*

## DR-REQ-271256/A-FMEM - BECM Fault

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - BECM Fault** | **ID**  DR-REQ-271256 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the BECM status is Missing or "Faulty" (BattChrgRdyStat\_D\_Actl = 0x5), the BCCM will stop charging and go to "Not Ready" (ChrgrRdyStat\_D\_Actl = 0x0).

## DR-REQ-271258/A-FMEM - Torque Status Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Torque Status Signal** | **ID**  DR-REQ-271258 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Power Pack Torque Status signal (PwPckTq\_D\_Stat) is missing and the HEV Wake line is high, the charger will treat the signal as "Power Pack on Torque Available (PwPckTq\_D\_Stat = 0x3).

If the Power Pack Torque Status signal (PwPckTq\_D\_Stat) is missing and the HEV Wake line is low, the charger will treat the signal as the last assumed value.

*Rationale/Notes*

*If the HEV wake is high, the charger can assume the vehicle is on, and it should assume torque is available and prevent charging for safety.*

*If the HEV wake is low, the last assumed value is the previous value that the charger either received or assumed (if for example HEV wake is high and the signal is missing). This is to avoid a situation where the BCCM sees a missing message, assumes Torque Available and stops charging, but then upon shut down it then assumes Torque not available, wakes up the module, and begins charging, only to go back to assuming torque available. By taking the last assumed state, the charger can safely charge after waking up the HEV powertrain without charging interruption.*

## DR-REQ-271259/B-FMEM - Gear Position Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Gear Position Signal** | **ID**  DR-REQ-271259 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the gear position signal (GearLvrPos\_D\_Actl) is missing and the HEV Wake is high, the charger should treat the signal as NOT in park (GearLvrPos\_D\_Actl != P).

If the gear position signal (GearLvrPos\_D\_Actl) is missing and the HEV Wake is low, the charger should treat the signal as its last known value.

If the gear position signal is “Unknown” (GearLvrPos\_D\_Actl = 0xE), the charger shall treat the signal as its last known value for 500ms (calibratable). After 500ms (calibratable), the charger shall treat the signal as missing per the above strategy.

If the gear position signal is “Neutral” (GearLvrPos\_D\_Actl = 0x2), the charger shall treat the signal as its last known value for 500ms (calibratable). After 500ms (calibratable), the charger shall treat the signal as its true value.

*Rationale/Notes*

*If the signal is missing and the HEV wake is high, the charger should assume the vehicle could be on or in motion and should not allow charging for safety.*

*If the signal is missing and the HEV wake is low, the charger should assume the vehicle is powered off and can charge if the last known value will allow charging.*

*On some strategies, the gear position signal may be “Neutral” for <100ms when the transmitting module wakes up. The BCCM needs to be robust to these short signal changes to prevent charge interruption. We are currently pursuing a strategy change to make sure this is “Unknown” instead of “Neutral” for future programs. Once this change is made, the requirement to filter “Neutral” will be removed.*

## DR-REQ-271262/A-FMEM - Battery Charge Ready Status

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Battery Charge Ready Status** | **ID**  DR-REQ-271262 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140444/A-Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=xJZVhemIx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Battery Charge Ready Status (BattChrgRdyStat\_D\_Actl) is missing, the charger will treat the signal as "Faulted" (BattChrgRdyStat\_D\_Actl = 0x5).

*Rationale/Notes*

*The charge can simply treat a missing BECM charge ready status as “not ready”, allowing it to shut down.*

## DR-REQ-140445/B-Continue Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **Continue Charging** | **ID**  DR-REQ-140445 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Continue Charging**

The BCCM shall continue charging if the following system conditions are true:

1. The BCCM Charger Ready Status is “Charger Ready” or “Charging” (ChrgrRdyStat\_D\_Actl = 0x1, 0x3)

AND

1. The BECM Battery Charge Ready Status is ‘Charging’ (BattChrgRdyStat\_D\_Actl = 0x3)

AND

1. The HPCM Charge Inhibit Request is NOT “Inhibit Charging” (BattChrgInhbt\_D\_Rq != 0x1)

*Note: While charging, the vehicle will not be able to shift out of Park, and will not be able to move to a torque available mode, so these system inputs are disregarded here.*

## DR-REQ-140446/B-End Plug-in Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **End Plug-in Charging** | **ID**  DR-REQ-140446 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**End Plug-in Charging**

Plug-in Charging shall be disabled if any of the following system conditions are true:

1. The BCCM Charger Status is NOT ‘Ready’ or “Charging” (ChrgrRdyStat\_D\_Actl != 0x1 or 0x3)

OR

1. The BECM Battery Charge Ready Status is NOT ‘Charging’ OR ‘Battery Charge Ready’ (BattChrgRdyStat\_D\_Actl != 0x2 or 0x3)

OR

1. The HPCM Charge Inhibit Request is “Charge Inhibit” (BattChrgInhbt\_D\_Rq = 0x1)

*Note: The HPCM may send Charge Inhibit if the vehicle has charge programming enabled and the low cost charge window has ended. See PEPC HLF for full set of requirements for charge programming.*

### DR-REQ-358756/A-BECM Charge Complete Declaration

|  |  |  |
| --- | --- | --- |
| **Title**  **BECM Charge Complete Declaration** | **ID**  DR-REQ-358756 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

When the BECM Charge Status transitions to “Charge Complete”, it shall remain in that state for at least 2 seconds (calibratable).

*Rationale/Notes*

*Other modules rely on the declaration of Charge Complete to perform their function. In order to give these modules time to wake up and perform their action, the BECM must hold the Charge Complete state for at least two seconds.*

## DR-REQ-140526/A-End Inductive Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **End Inductive Charging** | **ID**  DR-REQ-140526 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**End Inductive Charging**

Inductive Charging shall be disabled if any of the following conditions are true:

1. The BCCM Charger Status is NOT ‘Ready’ or “Charging” (ChrgrRdyStat\_D\_Actl != 0x1 or 0x3)

OR

1. The BECM Battery Charge Ready Status is NOT ‘Charging’ OR ‘Battery Charge Ready’ (BattChrgRdyStat\_D\_Actl != 0x2 or 0x3)

OR

1. The BECM has declared “Charge Complete” (BattChrgRdyStat\_D\_Actl = 0x4)

OR

1. The HPCM Charge Inhibit Request is “Charge Inhibit” (BattChrgInhbt\_D\_Rq = 0x1)

OR

1. The HPCM Power Pack Torque Status changes to a torque producing mode (PwPckTq\_D\_Stat = 0x03)

*Note 1: The HPCM shall send Charge Inhibit if the vehicle has charge programming enabled and the low cost charge window has ended.*

*Note 2: BCCM will no longer be ready if the ICCM is faulted.*

## DR-REQ-140541/A-BCCM Contactor Power Assertion

|  |  |  |
| --- | --- | --- |
| **Title**  **BCCM Contactor Power Assertion** | **ID**  DR-REQ-140541 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**BCCM Contactor Power Assertion**

The BCCM shall transition Contactor Power Relay to ‘Enable (ChrgrCnnctPwr\_B\_Stat = 0x1) under the following conditions:

1. BECM Charge Ready Status is “Battery Charge Wait”, “Battery Charge Ready” or “Charging” (BattChrgRdyStat\_D\_Actl = 0x1, 0x2, 0x3)

AND

1. The vehicle is in Park (GearLvrPos\_D\_Actl = 0x0)

OR

The vehicle is in Neutral (GearLvrPos\_D\_Actl = 0x2) AND the vehicle is Factory Mode (LifeCycMde\_D\_Actl = 0x1).

AND

1. The vehicle is not in a torque producing mode (PwPckTq\_D\_Stat != 0x3)

AND

1. The charge cord is locked (ChrgCordLck\_D\_Stat = 0x2) (EU vehicles only)

*Rationale/Notes*

*The charger needs to enable the CPE during charging, or when the 12V batter requires support.*

## DR-REQ-140542/C-BCCM Contactor Power De-Assertion

|  |  |  |
| --- | --- | --- |
| **Title**  **BCCM Contactor Power De-Assertion** | **ID**  DR-REQ-140542 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**BCCM Contactor Power De-Assertion**

The BCCM shall de-assert contactor power relay under the following conditions:

1. BECM CAN sustain is de-asserted (BattTracChrgSustn\_B\_Rq = 0x0) AND HEV wake is low

OR

1. The Main contactors are closed (BattTracCnnct\_D\_Cmd = 0x1) AND the vehicle is off plug (PlgActv\_D\_ActlChrgr = 0x0)

OR­­­­

1. The Charger Input Power Mode is “Digital Comm Detected” (ChrgrInPwMde\_D\_Actl = 0x2)

AND

The Digital Gateway mode is “AcEim” or “AcPnC/Eim “(DgtlCommGtwyMde\_D\_Stat = 0x4 or 0x6)

AND

The DC Charge Ready Status is “Initialization” (DcChrgRdy\_D\_Stat = 0x1)

AND

The Battery Charge Status is “Charge Wait” (BattChrgRdyStat\_D\_Actl = 0x1)

OR

1. The BCCM determines it must disable CPE per the HLVEM ENS requirements (DR-REQ-311150)

*Note: Cannot use “Not Ready” as the BECM may go to not ready before opening contactors, such as when charging is inhibited by the HPCM. The charge sustain is the best way to determine if the vehicle is going to charge.*

*For the use case of Charge 🡪 Run, the BCCM will not de-assert CPE due to HEV being high. Additional logic is required for the BCCM to de-assert once off plug.*

*The CPE must be disabled momentarily in digital communication sequences where BCB toggle is being triggered.*

## DR-REQ-140543/A-BCCM Contactor Power Diagnostics

|  |  |  |
| --- | --- | --- |
| **Title**  **BCCM Contactor Power Diagnostics** | **ID**  DR-REQ-140543 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**BCCM Contactor Power Diagnostics**

Prior to transitioning the contactor power relay from de-asserted to asserted the BCCM shall perform Open and Short Circuit detection. If either condition is detected, a DTC shall be set. If an open circuit is detected, contactor power shall not be asserted until the next charge cycle with no open circuit detected.

## DR-REQ-140546/B-Contactor Power- Invalid Contactor Command from BECM

|  |  |  |
| --- | --- | --- |
| **Title**  **Contactor Power- Invalid Contactor Command from BECM** | **ID**  DR-REQ-140546 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the vehicle is off plug, the BCCM shall de-assert the contactor power relay a calibratable time after receiving an invalid or missing value of BattTracCnnct\_D\_Cmd

*Note:*

*Effectively the BCCM can treat a missing or invalid value of this signal as “closed”. If on plug the BCCM should continue to assert CPE, but if off plug it pull CPE and shut down per the end charging requirements.*

## DR-REQ-221352/A-Conductive Charging Preferred

|  |  |  |
| --- | --- | --- |
| **Title**  **Conductive Charging Preferred** | **ID**  DR-REQ-221352 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137806/C-Conditions for Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i1f9otPrx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If both conductive (AC or DC) and inductive charging is available, the BCCM shall always choose to charge conductively, and will follow all restraints and requirements necessary for conductive charging.

*Rationale/Notes*

*Conductive charging is less flexible than inductive charging. In order to ensure safety and hardware protection, conductive charging and it’s requirements/restraints should always supersede inductive charging.*

## DR-REQ-235507/B-Raw Plug Status Signal

|  |  |  |
| --- | --- | --- |
| **Title**  **Raw Plug Status Signal** | **ID**  DR-REQ-235507 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137813/C-Detection of Plug Events[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=C7X1lqrFx3NrTD)] | **Down-Links**  DR-REQ-140555/A-Plug Status Fault Detection[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=RbVVRD6_x3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**Raw Plug Status Signal**

The BCCM shall determine the plug status of the vehicle and transmit it over CAN.

Signal Definition

Signal Name: PlgActv\_D\_ActlChrgr

Size: 2 bits

Values:

* 0x0 – Off Plug (Disconnected)
* 0x1 – On Plug (Connected)
* 0x2 – Not Used
* 0x3 – Faulty

Resolution: Discrete

Rate: 100 msec

Tx: BCCM

Rx: TCU, PCM, DCGM, BECM, HPCM

*Rationale/Notes*

*See BCCM IFS for details on determining plug status based on the cordset standard in each market (e.g. Prox and Pilot)*

### DR-REQ-140555/A-Plug Status Fault Detection

|  |  |  |
| --- | --- | --- |
| **Title**  **Plug Status Fault Detection** | **ID**  DR-REQ-140555 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-235507/B-Raw Plug Status Signal[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SwfxnjMXx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Plug Status Fault Detection**

The BCCM shall determine a faulted plug status per the Fault Tree Matrix below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **C344PHEV Charger Fault Tree Matrix** | |  |  |  |  |
|  |  |  |  |  |  |
| **INPUTS** | |  |  | **OUTPUTS** | |
| **Proximity Voltage** | **Pilot Vmax** | **# of  Faults** |  | **Charger Action** | **Plug Status** |
| NOTE: |  |  |  |  |  |
| Grey shaded INPUTS are "faulted" inputs | |  |  |  | PROXIMITY |
| White shaded INPUTS are normal inputs | |  |  |  | PILOT (Bad PROX) |
| Grey shaded OUTPUTS are ON\_PLUG (observable) | |  |  |  |  |
| Light Blue shaded OUTPUTS need OFF\_PLUG (observable) | |  |  |  |  |
| Pink shaded OUTPUTS need RESOLUTION (no observability / system choice) | |  |  |  |  |
| Dark Grey shaded CHARGER STATE are Not Design Intent | |  |  |  |  |
|  |  |  |  |  |  |
| Q: How does Charger measure -12V with the diode in the Pilot? A: If the charger measures -12V at the Pilot, then the diode is shorted (Charger Fault). | | |  |  |  |
| Q: What does the Charger do when there is a valid Pilot but No Proximity? A: The Charger will NOT charge. The Plug Status is ON-PLUG. | | |  |  |  |
| Q: How does the Proximity Voltage measure +5V ? A: The R5 resistor is OPEN in the Charger. | | |  |  |  |
|  |  |  |  |  |  |
| 5V (Short Circuit to 5V Fault) | 12V (R3 Open Fault) | 2 |  | **Do NOT Charge  Severity for Vehicle: PHEV = 7, BEV = 8** | ON\_PLUG |
| 5V (Short Circuit to 5V Fault) | 9V (Connected / Not Ready ) | 1 |  | ON\_PLUG |
| 5V (Short Circuit to 5V Fault) | 6V (Connected / Ready / No Ventilation) | 1 |  | ON\_PLUG |
| 5V (Short Circuit to 5V Fault) | 3V (Connected / Ready / Ventilation (Charger Fault)) | 2 |  | ON\_PLUG |
| 5V (Short Circuit to 5V Fault) | 0V (EVSE Disconnected) | 1 |  | FAULTY |
| 5V (Short Circuit to 5V Fault) | -12V (Fault) - DIODE SHORTED | 2 |  | ON\_PLUG |
| 4.56V (OFF\_PLUG) | 12V (R3 Open Fault) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 4.56V (OFF\_PLUG) | 9V (Connected / Not Ready ) |  |  | **Prepare for Charge** | ON\_PLUG |
| 4.56V (OFF\_PLUG) | 6V (Connected / Ready / No Ventilation) |  |  | **Ready to CHARGE** | ON\_PLUG |
| 4.56V (OFF\_PLUG) | 3V (Connected / Ready / Ventilation (Charger Fault)) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 4.56V (OFF\_PLUG) | 0V (EVSE Disconnected) |  |  | **Do NOT Charge** | OFF\_PLUG |
| 4.56V (OFF\_PLUG) | -12V (Fault) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 2.76V (ON\_PLUG\_S3\_OPEN) | 12V (R3 Open Fault) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 2.76V (ON\_PLUG\_S3\_OPEN) | 9V (Connected / Not Ready ) |  |  | **Prepare for Charge** | ON\_PLUG |
| 2.76V (ON\_PLUG\_S3\_OPEN) | 6V (Connected / Ready / No Ventilation) |  |  | **Ready to CHARGE** | ON\_PLUG |
| 2.76V (ON\_PLUG\_S3\_OPEN) | 3V (Connected / Ready / Ventilation (Charger Fault)) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 2.76V (ON\_PLUG\_S3\_OPEN) | 0V (EVSE Disconnected) |  |  | **Do NOT Charge** | ON\_PLUG |
| 2.76V (ON\_PLUG\_S3\_OPEN) | -12V (Fault) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 1.51V (ON\_PLUG\_S3\_CLOSED) | 12V (R3 Open Fault) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 1.51V (ON\_PLUG\_S3\_CLOSED) | 9V (Connected / Not Ready ) |  |  | **Prepare for Charge** | ON\_PLUG |
| 1.51V (ON\_PLUG\_S3\_CLOSED) | 6V (Connected / Ready / No Ventilation) |  |  | **Ready to CHARGE** | ON\_PLUG |
| 1.51V (ON\_PLUG\_S3\_CLOSED) | 3V (Connected / Ready / Ventilation (Charger Fault)) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 1.51V (ON\_PLUG\_S3\_CLOSED) | 0V (EVSE Disconnected) |  |  | **Do NOT Charge** | ON\_PLUG |
| 1.51V (ON\_PLUG\_S3\_CLOSED) | -12V (Fault) | 1 |  | **Do NOT Charge** | ON\_PLUG |
| 0V (Short Circuit to GND Fault) | 12V (R3 Open Fault) | 2 |  | **Do NOT Charge  Severity for Vehicle: PHEV = 7, BEV = 8** | ON\_PLUG |
| 0V (Short Circuit to GND Fault) | 9V (Connected / Not Ready ) | 1 |  | ON\_PLUG |
| 0V (Short Circuit to GND Fault) | 6V (Connected / Ready / No Ventilation) | 1 |  | ON\_PLUG |
| 0V (Short Circuit to GND Fault) | 3V (Connected / Ready / Ventilation (Charger Fault)) | 2 |  | ON\_PLUG |
| 0V (Short Circuit to GND Fault) | 0V (EVSE Disconnected) | 1 |  | FAULTY |
| 0V (Short Circuit to GND Fault) | -12V (Fault) | 2 |  | ON\_PLUG |

Note: The fault tree matrix is from Chris Ochocinski.

*Rationale/Notes:*

## DR-REQ-137808/C-Types of Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **Types of Charging** | **ID**  DR-REQ-137808 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137813/C-Detection of Plug Events[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=C7X1lqrFx3NrTD)] | **Down-Links**  DR-REQ-271049/B-EVSE Faulty - Cluster Notification[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TZcpvsgqx3NrTD)]  DR-REQ-271048/B-EVSE Not Compatible - Cluster Notification[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SCdpPxu7x3NrTD)]  DR-REQ-271039/A-EVSE Not Compatible[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=ziVlV$nxx3NrTD)]  DR-REQ-271040/A-EVSE Faulty[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TbclV$nxx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall determine if the vehicle is actively connected to an off-board charging device and communicate the Charger Input Power Mode over CAN.

*Note: All plug-in vehicles shall have an AC charging inlet port. Some vehicle shall be equipped with an additional HV DC charging inlet port or an Inductive Charge Coil.*

Signal Definition

Signal Name: ChrgrInPwMde\_D\_Actl

Size: 4 bits

Values:

* 0x0 – EVSE Not Detected
* 0x1 – EVSE Paused
* 0x2 – Digital Comm Detected
* 0x3 – AC Basic
* 0x4 – AC Digital
* 0x5 – DC Charging
* 0x6 – Inductive Charging
* 0x7 – EvseNotCompatible
* 0x8 – EvseFaulty
* 0x9 – DigitalCommEnd
* 0xA – Not used
* 0xB – Not used
* 0xC – Not used
* 0xD – Not used
* 0xE – Not used
* 0xF – Not used

Resolution: Discrete

Rate: 100 msec

Tx: BCCM

Rx: TCU, BECM, HPCM, IPC, DCGM

*Rationale/Notes*

*Below is a definition of the states of ChrgrInPwMde\_D\_Actl:*

* *EVSE Not Detected – The default state, this indicates there is not EVSE detected at the charge port. It can also represent a dead EVSE (cable with no external power). Note that the prox is still capable of setting the plug status even if there is no EVSE detected*
* *EVSE Paused – the EVSE is connected, but is not transferring power (Pilot Duty Cycle = 100%). Usually this is because the EVSE has been manually paused, or is automatically paused and waiting for a payment from the customer.*
* *AC Basic – the attached EVSE is a basic Level 1 or Level 2 AC charger. “Basic” in this term means that the EVSE power is transmitted via the analog Pilot signal (Pilot Duty Cycle between 10% and 95%)*
* *AC Digital – the attached EVSE is a Level 1 or Level 2 AC Charger that uses Digital Communication to transmit the EVSE power, instead of the analog Pilot signal (Pilot Duty Cycle = 5%)*
  + *As of Gen 4, PHEV vehicles are incapable of charging with an AC Digital EVSE. In this case, ChrgrInPwMde will switch to EVSE Not Compatible.*
  + *AC Digital EVSEs are currently very rare, and are capable of switching to AC Basic charging by calling the EVSE manufacturer.*
* *DC Charging – the attached EVSE is a DC Fast Charger*
* *Inductive Charging – the vehicle is currently charging via an inductive charger.*
* *EVSE Not Compatible – The attached EVSE is not capable of charging the vehicle.*
  + *This is most likely because an AC Digital charger is attached to a vehicle incapable of digital communitcation.*
  + *Additional HMI for incompatible EVSEs is described in DR-REQ-XXXX*
* *EVSE Faulty – The charging system has determined that there is a fault on the EVSE and Charging may be disabled as a result*
  + *Additional HMI for Faulty EVSEs is described in DR-REQ-XXXX*

### DR-REQ-271039/A-EVSE Not Compatible

|  |  |  |
| --- | --- | --- |
| **Title**  **EVSE Not Compatible** | **ID**  DR-REQ-271039 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-137808/C-Types of Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i8QxmyXVx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM will set the Charger Input Power Mode to “EVSE Not Compatible” (ChrgrInPwMde\_D\_Actl = 0x7) if the Pilot Duty Cycle is 5% and the vehicle is incapable of communicating over a digital interface.

*Rationale/Notes*

*Some Level 2 chargers exist that communicate using a digital system instead of the Pilot Duty Cycle. PHEVs currently do not have a DCGM and are thus incapable of charging with this protocol. The vehicle should attempt to alert the customer so the customer may contact the EVSE manufacturer.*

### DR-REQ-271040/A-EVSE Faulty

|  |  |  |
| --- | --- | --- |
| **Title**  **EVSE Faulty** | **ID**  DR-REQ-271040 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-137808/C-Types of Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i8QxmyXVx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The charger will set the Charger Input Power Mode to “EVSE Faulty” (ChrgrInPwMde\_D\_Actl = 0x8) if it determines there is a fault on the external charger. Any time the charger sets “EVSE Faulty” there should be an associated DTC.

*Rationale/Notes*

*The use cases to determine an external charger fault are complex and should be defined at the subsystem or feature level.*

## DR-REQ-193866/C-BCCM Event Wakeups

|  |  |  |
| --- | --- | --- |
| **Title**  **BCCM Event Wakeups** | **ID**  DR-REQ-193866 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137813/C-Detection of Plug Events[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=C7X1lqrFx3NrTD)] | **Down-Links**  DR-REQ-261820/B-Charger Power Available Change Wake Event[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=yuQtpdHJx3NrTD)]  DR-REQ-261819/D-Charging Status Change Wake Event[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=D$d1rpHkx3NrTD)]  DR-REQ-261818/A-Plug Status Event Wakeup[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=Dxahf5okx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall assert the HEV\_Wake hardline and set the appropriate Event Wakeup CAN signal as TRUE for the following events:

* Plug Status Event
* Charging status Change Event
* Charger Power Available Change Event

### DR-REQ-261818/A-Plug Status Event Wakeup

|  |  |  |
| --- | --- | --- |
| **Title**  **Plug Status Event Wakeup** | **ID**  DR-REQ-261818 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-193866/C-BCCM Event Wakeups[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=BqYd9u55x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall drive the HEV\_Wake hardline high and send Plug Status Event Wakeup CAN signal (*PlgStatEvnt\_B\_Stat*) as TRUE if:

1. The PILOT changes from 0% to any nonzero value (Plug in event detected)

OR

1. The PILOT changes from any nonzero value to 0% (Unplug event detected)

OR

1. Any change in PROX is detected (plug or unplug event detected)

*Notes:*

*No Wakeup on transition from off plug to on plug due to DC fast charging or digital comm AC charging. Delays in the digital comm process make this wakeup unnecessary.*

### DR-REQ-261819/D-Charging Status Change Wake Event

|  |  |  |
| --- | --- | --- |
| **Title**  **Charging Status Change Wake Event** | **ID**  DR-REQ-261819 | **Revision**  D  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-193866/C-BCCM Event Wakeups[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=BqYd9u55x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall drive the HEV\_Wake hardline high and send the Charging Status Change Event Wakeup CAN Signal (*ChrgChngEvnt\_B\_Stat*) as TRUE upon:

1. Charger charge status (ChrgrRdyStat\_D\_Actl) has any change of state

OR

1. Transitions from DCGM status from ‘initialization’ to ready’

OR

1. When BCCM needs to send Charge Change Request to HPCM

OR

1. The Charge Cord Unlock Button has been pushed

OR

1. The BCCM must re-lock the charge cord per the Cord Re-lock strategy for EU (DR-REQ-271509)

*Notes:*

*In order to unlock the charge cord in certain use cases, the BCCM needs voltage on the bus to drop below a threshold. This voltage is reported by the BECM. As such, the BCCM must ensure the BECM is awake when a cord unlock request is received.*

### DR-REQ-261820/B-Charger Power Available Change Wake Event

|  |  |  |
| --- | --- | --- |
| **Title**  **Charger Power Available Change Wake Event** | **ID**  DR-REQ-261820 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-193866/C-BCCM Event Wakeups[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=BqYd9u55x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall drive the HEV\_Wake hardline high and send the Charger Power Available Change Event Wakeup CAN Signal (*ChrgrAvailEvnt\_B\_Stat*) as TRUE when:

1. The Input power available (ChrgrIn\_Pw\_Mx) changes by more than a calibratable amount (100W default)

OR

1. The Pilot signal changes by more than a calibratable amount (5% default)

OR

1. ChrgrInPwMde\_D\_Actl has any transition of state.

*Notes:*

*The power available change will capture transitions into and out of the EVSE pause modes. Using ChrgrInPwMde\_D\_Actl will cover cases where duty cycle of Pilot doesn’t meet the calibratable change in power for state transitions like Digital Comm Detected to EVSE Not Compatible, needing to communicate EVSE Faulty to the Cluster & TCU, etc.*

## DR-REQ-193486/B-DC Fast Charge - Unlocking EVSE

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge - Unlocking EVSE** | **ID**  DR-REQ-193486 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links**  DR-REQ-193490/B-DC Fast Charge - Unlock Request[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iEW1$WWfx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**DC Fast Charge – Unlocking EVSE**

**This requirement is for North America, Europe and Asia Pacific vehicles.**

Depending on the market, the charger shall unlock the EVSE Plug when a DC Fast Charge is complete, or when a valid unlock request is received (See DR-REQ-193490).

|  |  |  |
| --- | --- | --- |
| **Market** | **Unlock on DCFC Complete or request** | **Unlock on request only** |
| *North America* | X |  |
| *Europe* |  | X |
| *China* | X |  |

In addition, the DC Charge Contactor Voltage (BattDcChrg\_U\_Actl) must be below 60V.

*Rationale/Notes*

*Europe must stay locked after charge complete because it relies on the actuating pin to hold the DC cord to the charge port. NA and China have separate latches for holding the cord to the charge port and locking the cord to the charge port.*

*The DC Charge Contactors must be below 60V before unlocking the cord per J1772 standards.*

### DR-REQ-193490/B-DC Fast Charge - Unlock Request

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge - Unlock Request** | **ID**  DR-REQ-193490 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-193486/B-DC Fast Charge - Unlocking EVSE[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SQe562dxx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DC Fast Charge – Unlock Request**

**This requirement is for all markets.**

The BCCM shall consider a DCFC Unlock Request fulfilled if the Charge Mode is DC Fast Charge (ChrgrInPwMde\_D\_Actl = 0x5) and the following conditions are true:

1. The charge mode is DC Fast Charge or Digital Comm Detected (ChrgrInPwMde\_D\_Actl = 0x5, 0x2)

AND

1. Either
   1. The CSI Unlock Button is pressed

OR

* 1. A cord unlock is requested from the APIM (ChrgCordUnlock\_B\_Rq = 0x1)

*Note: No key fob search or door lock status is required for DC Fast Charging. There is a master button on the charging stations for shutting down charging which will result in a cord set unlock and the DC Fast Charge cords are attached to the DC Fast Charge Stations, so no security is required for the cord set.*

## DR-REQ-193488/A-DC Fast Charge - Cord Lock During Power Transfer

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge - Cord Lock During Power Transfer** | **ID**  DR-REQ-193488 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DC Fast Charge – Cord Lock During Power Transfer**

The charge EVSE shall remain locked during DC fast charge power transfer.

## DR-REQ-258010/B-AC Charging Unlock Requirements

|  |  |  |
| --- | --- | --- |
| **Title**  **AC Charging Unlock Requirements** | **ID**  DR-REQ-258010 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links**  DR-REQ-193483/C-Conductive Charging - Cord Unlock Request[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SsV5Bl6Px3NrTD)]  DR-REQ-271247/B-AC Cord Lock - APIM Enable[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=yiepMlh2x3NrTD)]  DR-REQ-193495/C-Conductive Charging - Unlocking Cord Set[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i5c16LGYx3NrTD)]  DR-REQ-193484/A-CAN Request for Secure Cord Unlock - BCM[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SoYV8C5Lx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**AC Charging Unlock Requirements**

The vehicle shall be capable of unlocking the charge cord during AC charging in markets where required.

### DR-REQ-193483/C-Conductive Charging - Cord Unlock Request

|  |  |  |
| --- | --- | --- |
| **Title**  **Conductive Charging - Cord Unlock Request** | **ID**  DR-REQ-193483 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV], BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-258010/B-AC Charging Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i7UpXf4Ax3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**AC Conductive Charging – Cord Unlock Request**

**This requirement is for European Markets on Vehicles equipped with PEPS.**

The charger shall request a secure unlock from the BCM using a custom security code if the following conditions are true:

1. The charge mode is Paused, AC Basic, Digital Comm Detected, AC Digital, or EVSE Not Detected (ChrgrInPwMde\_D\_Actl = 0x0, 0x1, 0x2, 0x3, 0x4)

AND

1. Either
   1. The CSI Unlock Button is pressed

OR

* 1. A cord unlock is requested from the APIM (ChrgCordUnlock\_B\_Rq = 0x1)

*Rationale/Notes:*

*The algorithm is defined in the BCM Charge Port Function Spec.*

*The CAN signals used for the custom security code are as follows:*

* *ChrgCordChlng1\_No\_Actl*
  + *MSB of the challenge code from the BCCM to request a charge port unlock*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCCM*
  + *Rx: BCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordChlng2\_No\_Actl*
  + *LSB of the challenge code from the BCCM to request a charge port unlock*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCCM*
  + *Rx: BCM*
  + *Initial Value: 0*
  + *Domain: 0-255*

*Additionally, the challenge code and response is based on the vehicle’s VIN number (VehicleGGCCData) per the BCM Charge Port Function Spec.*

### DR-REQ-193495/C-Conductive Charging - Unlocking Cord Set

|  |  |  |
| --- | --- | --- |
| **Title**  **Conductive Charging - Unlocking Cord Set** | **ID**  DR-REQ-193495 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-258010/B-AC Charging Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i7UpXf4Ax3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**AC Conductive Charging – Unlocking Cord Set**

**This requirement is for European Markets and North American BEVs.**

The Charging System shall unlock the conductive cord set if following conditions are met:

1. The charge cord is locked (ChrgCordLck\_D\_Stat = 0x2 Locked) or confirmed to be “retain” (ChrgCordLck\_D\_Stat = 0x0)

AND

1. Either
   1. The BCM indicates that a valid key fob was found and it is OK to unlock (ChrgCordLck\_B\_Stat = 0x1) AND the message is validated using a challenge/response algorithm.

OR

* 1. The BECM charge status is “Charge Complete” (BattChrgRdy\_D\_Stat = 0x4) (North American BEVs only)

AND

1. S2 is Open

AND

1. AC Voltage < 50V

*Rationale/Notes:*

*For North American BEVs, the cord is only locked in order to allow the customer to fully charge without another plug-in owner taking their charge cord. Once charging has completed, the customer is no longer concerned with “holding” the charger in a public station, and would rather have it unlocked and available for other customers.*

*See Charge Port unlock Feature Spec for details*

*In order to secure the charge cord, the charger will only unlock the cord after an authorized code has been received from the BCM indicating that a key fob is detected. The algorithm is defined in the BCM Charge Port Function Spec.*

*The CAN signals for unlocking are described below. The Challenge and Response signals are divided into MSB and LSB to allow for differences in endianness.*

* *ChrgCordLck\_B\_Stat*
  + *Unlock command from BCM*
  + *Size: 1 bit*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *States*
    - *0x0 – NULL*
    - *0x1 – UNLOCK*
* *ChrgCordChlng1\_No\_Actl*
  + *MSB of the challenge code from the BCCM to request a charge port unlock*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCCM*
  + *Rx: BCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordChlng2\_No\_Actl*
  + *LSB of the challenge code from the BCCM to request a charge port unlock*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCCM*
  + *Rx: BCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordResp1\_No\_Actl*
  + *MSB of the response code from the BCM to unlock the charge port*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordResp2\_No\_Actl*
  + *LSB of the response code from the BCM to unlock the charge port*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *Domain: 0-255*

*Additionally, the challenge code and response is based on the vehicle’s VIN number (VehicleGGCCData) per the BCM Charge Port Function Spec.*

*“Confirmed to be retain” means that the status is retain (power up default) and has been confirmed to be in the retain state after reading the lock actuator pins.*

#### DR-REQ-316891/A-Unlocking FMEM - AC Voltage

|  |  |  |
| --- | --- | --- |
| **Title**  **Unlocking FMEM - AC Voltage** | **ID**  DR-REQ-316891 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the AC Voltage has been greater than 50V for 5s and all other cord unlock requirements are met, the BCCM shall set a DTC against the EVSE and unlock the charge cord.

*Rationale/Notes:*

*In some cases, the AC voltage may not drop below 50V. Since there is no risk of electric shock or arc, it is safe to unlock and allow the cord to be unplugged, but the charger should set an informational DTC against the EVSE.*

### DR-REQ-193484/A-CAN Request for Secure Cord Unlock - BCM

|  |  |  |
| --- | --- | --- |
| **Title**  **CAN Request for Secure Cord Unlock - BCM** | **ID**  DR-REQ-193484 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  191001\_Body Control Module | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-258010/B-AC Charging Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i7UpXf4Ax3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**CAN Request for Secure Cord Unlock – BCM**

When a CAN message for a Secure Cord Unlock is received from the charger the BCM shall send a message to the charger indicating that a cord unlock is authorized if the following conditions are true:

1. The vehicle doors are unlocked

OR

1. A key fob search has been initiated and a valid key fob has been detected within range of the vehicle

The BCM shall also send a valid security key in response to the challenge code sent by the BCCM.

*Note: Due to security it was recommended that the search area be limited to the Inlet Port external area, if the car is unlocked someone can press the unlock charge cord button and unlock the cord set.*

*The algorithm is defined in the BCM Charge Port Function Spec.*

*The signals sent by the BCM responding to the challenge code are as follows:*

* *ChrgCordResp1\_No\_Actl*
  + *MSB of the response code from the BCM to unlock the charge port*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordResp2\_No\_Actl*
  + *LSB of the response code from the BCM to unlock the charge port*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordLck\_B\_Stat*
  + *Unlock status of the charge port*
  + *Size: 1 bit*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *States*
    - *0x0 – NULL*
    - *0x1 – UNLOCK*

*Additionally, the challenge code and response is based on the vehicle’s VIN number (VehicleGGCCData) per the BCM Charge Port Function Spec.*

### DR-REQ-271247/B-AC Cord Lock - APIM Enable

|  |  |  |
| --- | --- | --- |
| **Title**  **AC Cord Lock - APIM Enable** | **ID**  DR-REQ-271247 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  150102\_Center Stack Display | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-258010/B-AC Charging Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i7UpXf4Ax3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

~~In North American Markets, the APIM shall include a screen to allow the customer to enable or disable AC Cord Lock. It shall send a signal to the BCCM saying if AC Cord Lock is Enabled or Disabled.~~

~~Signal Definition~~

~~Signal Name: ChrgCrdLckEnbl\_B\_Stat~~

~~Size: 1 bit~~

~~Values:~~

* ~~0x0 – Not Enabled~~
* ~~0x1 – Enabled~~

~~Rate: 1000 ms E/P~~

~~Tx: APIM~~

~~Rx: BCCM~~

*Rationale/Notes:*

*This requirement is currently not being implemented*

## DR-REQ-271059/B-Cord Re-lock strategy for EU

|  |  |  |
| --- | --- | --- |
| **Title**  **Cord Re-lock strategy for EU** | **ID**  DR-REQ-271059 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

In EU markets, the charger shall lock the charge cord after a cord unlock command if the charge cord is “Unlocked” (ChrgCordLck\_D\_Stat = 0x1) and the plug status is “Plugged in” (PlgActv\_D\_ActlChrgr = 0x1) for 60s (calibratable).

*Notes/Rationale*

*Since EU relies on the cord lock to hold the charge port in the charge port inlet, a re-lock strategy must be in place in case the customer unlocks the cord but does not remove it from the charge port inlet.*

### DR-REQ-369553/A-HEV Wake for cord re-lock

|  |  |  |
| --- | --- | --- |
| **Title**  **HEV Wake for cord re-lock** | **ID**  DR-REQ-369553 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

## DR-REQ-193482/A-Unlocking Cord Set Button - Inlet Port Housing

|  |  |  |
| --- | --- | --- |
| **Title**  **Unlocking Cord Set Button - Inlet Port Housing** | **ID**  DR-REQ-193482 | **Revision**  A  **Status**  Released |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-232138/A-Cord Unlock Button[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=BvZdZ_D$x3NrTD)]  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**EVSE Unlocking Button – Inlet Port Housing**

**This is for the European Markets and NA markets with DC fast Charge**

The inlet port housing shall be equipped with a button that can wake the BCCM and request a cord unlock.

*Note: The Inlet Port button can be hard wired to the BCCM, or it can be included as part of a module that sends a message to the BCCM via LIN or CAN.*

*In Gen IV vehicles, the inlet port button is a component of the Charge Status Indicator. The CSI will wake the BCCM over LIN when the inlet button is pushed, and send the request for charge cord unlock.*

## DR-REQ-194504/A-Detection of EVSE Unlock Button

|  |  |  |
| --- | --- | --- |
| **Title**  **Detection of EVSE Unlock Button** | **ID**  DR-REQ-194504 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Detection of EVSE Unlock Button**

The BCCM shall be capable of waking if the EVSE Unlock Button is pressed.

*Rationale/Notes:*

*The Unlock Button will be incorporated into the CSI module at the charge port, and will wake the BCCM over a LIN network when pressed.*

## DR-REQ-245719/C-Cord Lock Timing Requirements

|  |  |  |
| --- | --- | --- |
| **Title**  **Cord Lock Timing Requirements** | **ID**  DR-REQ-245719 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links**  DR-REQ-245725/C-Cord Lock Timing - AC Digital Unlock[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SYV15HHdx3NrTD)]  DR-REQ-242194/B-FMEM - Locking EVSE[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i6atRVJ8x3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**Cord Lock Timing Requirements**

For all EVs, cord actuator shall lock within 2000ms when the vehicle is not in a torque producing mode (PwPckTq\_D\_Stat !=0x3) AND the Pilot or Prox is present with the correct value based on marked in the table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Market* | Never Lock | Lock when Pilot = 5% AND ChrgrInPwMde\_D\_Actl = 0x2, 0x5 | Lock when  [Pilot > 0 OR Prox is detected] | Lock when  [Pilot > 0 OR Prox is detected] AND ChrgCrdLckEnbl\_B\_Stat = 0x1 ENABLED |
| EU (BEV & PHEV) |  |  | X |  |
| NA (BEV) |  | X |  | X |
| NA (PHEV) | X |  |  |  |
| China (BEV) |  |  | X |  |
| China (PHEV) | X |  |  |  |

*Notes/Rationale:*

*In EU, the cord lock is necessary to secure the EVSE to the car. Thus, the vehicle should lock as soon as possible when any pilot or prox is detected.*

*In NA, cord lock is only needed for DC fast charge, which can only occur if the pilot is 5% (digital communication) REQ-245725 details the unlock step necessary if the digital communication transforms into AC Digital.*

*In China, only the BEV needs the AC cord locked, but it is not constrained to DC only as the AC chargers are capable of exceeding 16A.*

### DR-REQ-245725/C-Cord Lock Timing - AC Digital Unlock

|  |  |  |
| --- | --- | --- |
| **Title**  **Cord Lock Timing - AC Digital Unlock** | **ID**  DR-REQ-245725 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-245719/C-Cord Lock Timing Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=rcUx$W2lx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Cord Lock Timing – AC Digital Unlock**

In the NA market, if

1. the lock actuator is engaged (ChrgCordLck\_D\_Stat = 0x2)

AND

1. the Charger Mode changes to “AC Basic” or “AC Digital” (ChrgrInPwMde\_D\_Actl = 0x3, 0x4)

AND

1. The AC Cord Lock Enable is “Not Enabled” (ChrgCrdLckEnbl\_B\_Stat = 0x0)

then the BCCM shall unlock the cord within 2000ms.

*NA market BEVs do not require cord lock on AC charging. Since the cord locks when digital communication is detected, additional logic is required to unlock the cord in the case of an EVSE that communicates via PLC.*

### DR-REQ-354198/A-Re-lock cord after BCB Toggle

|  |  |  |
| --- | --- | --- |
| **Title**  **Re-lock cord after BCB Toggle** | **ID**  DR-REQ-354198 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall re-lock the charge cord if the following conditions are true:

* The charge cord is unlocked
* The charger has performed a BCB Toggle
* The EVSE Status is “Digital Communication Detected”, “DC Charging” or “AC Digital Charging”
* The BECM charge status is “Charge Wait”

*Rationale/Notes*

*BCB toggle is a strategy for the BCCM to reset a digital charging system after communication has failed. See charger IFS for BCB Toggle requirements.*

## DR-REQ-271058/B-Unlocking EVSE FMEM - CSI Stuck Button

|  |  |  |
| --- | --- | --- |
| **Title**  **Unlocking EVSE FMEM - CSI Stuck Button** | **ID**  DR-REQ-271058 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the CSI is reporting an unlock button press for more than 30 seconds (calibratable), then it can assume the Cord Unlock button is stuck.

If the charger determines that the cord unlock button is stuck, then it must take the following FMEM actions:

* Set a “Stuck Cord Unlock Button” DTC
* Ignore all future Unlock commands from the CSI until the CSI button state changes to “Not Pressed” – retain the Stuck Unlock Button Status in memory after shutdown.

*Rationale/Notes:*

*The CSI will only send a wakeup on button change – so only the first press of a stuck button will wake up the BCCM. After detecting a lock, the BCCM should retain the value of the stuck button in memory until the CSI reports the button to be “not pressed”. Without this, the BCCM would obey the button press on every new EV Wake, which would be especially disruptive for the charge change button.*

## DR-REQ-271057/A-Unlocking EVSE FMEM - APIM Missing Message

|  |  |  |
| --- | --- | --- |
| **Title**  **Unlocking EVSE FMEM - APIM Missing Message** | **ID**  DR-REQ-271057 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the APIM Cord Unlock Command message (ChrgCordUnlock\_B\_Rq) is missing, the charger shall set an informational DTC.

*Rationale/Notes*

*It is important to note the missing message, but the charger should take no other action, as it is important to not unlock the charge cord unless absolutely necessary.*

## DR-REQ-242195/A-FMEM - Unlocking EVSE

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Unlocking EVSE** | **ID**  DR-REQ-242195 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the inlet port cord unlock fails (after re-try), the BCCM shall perform the following FMEM actions:

* Cease charging the HV battery
* Set a DTC for cord unlock error
* Set the Cord Lock Status to “Unlock Fail” (ChrgCordLck\_D\_Stat = 0x5)
* Send a “Cord Lock Stuck” message to the cluster (NEED SIGNAL)
* Set the CSI to display an internal fault state

*Rationale/Notes*

## DR-REQ-281270/C-Cord Lock Fault Alert

|  |  |  |
| --- | --- | --- |
| **Title**  **Cord Lock Fault Alert** | **ID**  DR-REQ-281270 | **Revision**  C  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the charge cord is locked and a fault is detected, the BCCM shall alert the cluster and APIM of a cord lock fault using the Charge Cord Lock Fault signal (ChrCrdLck\_D\_Falt) according to the fault matrix below:

|  |  |
| --- | --- |
| **Failure** | **ChrgCrdLck\_D\_Falt** |
| CSI Stuck Button Pressed (See DR-REQ-271058) | 0x1 – CsiFault |
| CSI – Lost LIN Communication | 0x1 – CsiFault |
| Cord Lock Actuator Failure | 0x2 – HardwareFault |
| BCM Missing Communication DTC | 0x2 – HardwareFault |
| BECM Missing Communication DTC | 0x2 – HardwareFault |
| DC Input voltage is too high to unlock | 0x2 – HardwareFault |

*Rationale/Notes*

*HMI exists to inform the customer that there is a cord lock system fault that is preventing them from unlocking and removing the charge cord, and thus from moving the vehicle (due to torque disable while on plug). This HMI will direct the customer to the proper failure override so they can get their car moving under its own power again so they can drive to a dealership for repair.*

## DR-REQ-242194/B-FMEM - Locking EVSE

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Locking EVSE** | **ID**  DR-REQ-242194 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-245719/C-Cord Lock Timing Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=rcUx$W2lx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**FMEM – Locking EVSE**

If the cord lock operation fails (after a re-try attempt), the BCCM shall implement the following FMEM protocols:

1. Set a DTC against the cord lock
2. Transition to a “not ready to charge” state (ChrgrRdyStat\_D\_Actl = 0x0)
3. Set the cord lock status to “Lock Fail” (ChrgCordLck\_D\_Stat = 0x6)
4. Display a “Faulted” state on the CSI

*Rationale/Notes*

*Charging needs to be disabled in the event of a cord lock failure.The customer must be notified that their vehicle is not charging, but a dealer must be able to differentiate a cord lock issue from a BCCM issue.*

## DR-REQ-221996/B-DC Fast Charge Start Charging Requirements

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge Start Charging Requirements** | **ID**  DR-REQ-221996 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-209498/C-DC Fast Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iMf1lqrFx3NrTD)] | **Down-Links**  DR-REQ-242118/B-DCFC DCGM Charge Initialization[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=C8XxLsSFx3NrTD)]  DR-REQ-242074/A-DCFC BECM Charge Wait[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=y3XhSaLRx3NrTD)]  DR-REQ-242120/A-DCFC BCCM Charge Ready[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=D9Xhiy_4x3NrTD)]  DR-REQ-242124/A-DCFC BECM Charge Ready[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=Dabhiy_4x3NrTD)]  DR-REQ-242122/B-DCFC DCGM Cable Check and Precharge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=SpVxLsSFx3NrTD)]  DR-REQ-242128/B-DCFC BECM Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i8Q1Ttt5x3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC Start Charging Requirements**

The DCGM shall begin charging if the following system conditions are true:

1. The BCCM charge status is “Charger Ready” (ChrgrRdyStat\_D\_Actl = 0x1)

AND

1. The BECM charge Status is “Charge Ready” (BattChrgRdyStat\_D\_Actl = 0x2)

AND

1. The EVSE is ready to deliver power.

AND

1. The DCGM is ready to transfer power.

*Rationale/Notes*

*Special requirements DC charging (such as locking the cordset) can be found in the requirements BCCM and BECM Charge Ready requirements*

### DR-REQ-242074/A-DCFC BECM Charge Wait

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC BECM Charge Wait** | **ID**  DR-REQ-242074 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC BECM Charge Wait**

The BECM shall transition to “Charge Wait” when the following system conditions are true:

1. The HPCM Charge Inhibit status is NOT “Inhibit Charging” (BattChrgInhbt\_D\_Rq != 0x01)

AND

1. The Charge Mode is “Digital Comm Detected” (ChrgrInPwMde\_D\_Actl =0x2) or “DC Charge (ChrgrInPwMde\_D\_Actl = 0x05)

AND

1. The SOC is below a calibratable Charge Threshold (BattTracSoC\_Pc\_Actl < 98%; calibratable)

AND

1. The BECM is ready to transition to “Charge Wait”

**Rationale/Notes**

*HPCM will never send “Inhibit Charging” if the charge mode is Digital Comm Detected or DC Charging.*

*DC Charging should only begin when the vehicle is below an SOC that will allow DC charging. Otherwise, the system should default to AC Digital Charging.*

### DR-REQ-242118/B-DCFC DCGM Charge Initialization

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC DCGM Charge Initialization** | **ID**  DR-REQ-242118 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC DCGM Charge Initialization**

The DCGM shall initialize the digital communication when the following system conditions are true

1. The Charge Mode is “Digital Comm Detected” (ChrgrInPwMde\_D\_Actl = 0x2)

AND

1. The BCCM Charge Mode Command is “Attempt Digital Communication” (DgtlCommGtwyMde\_D\_Rq = 0x1)

AND

1. The DCGM is ready to initialize digital communications

When completed, the DCGM shall set the DCGM Charge Status to “Charge Ready” (DcChrgRdy\_D\_Stat = 0x2)

*Rationale/Notes*

*DC Charge Initialization begins once the BECM is in Charge Wait. Setting the Charge Service to DC Charge notifies the BCCM to enable CPE and transition the charge mode to DC Charging.*

### DR-REQ-242120/A-DCFC BCCM Charge Ready

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC BCCM Charge Ready** | **ID**  DR-REQ-242120 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC BCCM Charge Ready – NA and EU**

The BCCM shall close S2 and transition to “Charge Ready” when the following system conditions are true:

1. The DCGM Charge Status is “DC Charge Ready” (DcChrgRdy\_D\_Stat = 0x2)

AND

1. The Charge Cord is Locked (ChrgCordLck\_D\_Stat = 0x2)

AND

1. The BECM Isolation Detection is “Disabled” (BattTracIsoDis\_B\_Stat = 0x1)

AND

1. The BECM Charge Status is “Charge Wait” (BattChrgRdyStat\_D\_Actl = 0x1)

AND

1. The vehicle is in PARK (GearLvrPos\_D\_Actl = 0x0)

AND

1. The vehicle is NOT in a torque producing mode (PwPckTq\_D\_Stat != 0x3)

AND

1. The BCCM is ready to transition to “Charge Ready”

*Rationale/Notes*

*The above system conditions verify that the vehicle is ready to accept a DC charge. Once the BCCM transitions to Charge Ready the DCFC will initiate the precharge process*

### DR-REQ-242122/B-DCFC DCGM Cable Check and Precharge

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC DCGM Cable Check and Precharge** | **ID**  DR-REQ-242122 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC DCGM Cable Check and Precharge**

The DCGM shall perform a cable check and transition to “Precharge” when the following system conditions are true:

1. BCCM Charge Status is “Charger Ready” (ChrgrRdyStat\_D\_Actl = 0x1)

AND

1. S2 is closed (ChrgrS2Swtch\_B\_Stat = 1)

AND

1. The DCGM is ready to perform a cable check

*Rationale/Notes*

*The BCCM transitioning to “charge ready” is an indication that S2 is closed and the DCGM can begin cable check. Once cable check is complete the DCGM can transition to the “Precharge” state.*

*This requirement only applies to NA and EU markets. In China, the EVSE will perform the cable check and precharge the bus after the contactors are closed*

### DR-REQ-242124/A-DCFC BECM Charge Ready

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC BECM Charge Ready** | **ID**  DR-REQ-242124 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC BECM Charge Ready**

The BECM shall not transition to “Charge Ready” unless the following System Conditions are true:

1. The DCGM Charge Status is “PreCharge” (DcChrgRdy\_D\_Stat = 0x4) (NA &EU)

OR

The DCGM Charge Status is “GBTPreCharge” (DcChrgRdy\_D\_Stat = 0x7) (CH)

AND

1. The BECM is ready to transition to “Charge Ready”

*Rationale/Notes*

*Once the DCGM performs the cable check and is ready to close contactors, the BECM can transition to charge ready and close the DC contactors*

### DR-REQ-242128/B-DCFC BECM Charging

|  |  |  |
| --- | --- | --- |
| **Title**  **DCFC BECM Charging** | **ID**  DR-REQ-242128 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-221996/B-DC Fast Charge Start Charging Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=S4VxZ6s7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**DCFC BECM Charging**

The BECM shall transition to “Charging” when the following system conditions are true:

1. The BECM Charge Status is “Charge Ready” (BattChrgRdyStat\_D\_Actl = 0x2)

AND

1. The DC Charge contactors have been closed

AND

1. The DCGM Charge Status is “PreCharge” (DcChrgRdy\_D\_Stat = 0x4) (NA &EU)

OR

The DCGM Charge Status is “GBTPreCharge” (DcChrgRdy\_D\_Stat = 0x7) (CH)

AND

1. The BECM is ready to transition to “Charging”

Upon transitioning to “Charging”, the BECM shall send the voltage and current set points as necessary to charge the traction battery.

*Rationale/Notes*

*The BECM can begin charging the traction battery once the DC contactors are closed.*

### DC Charge FMEM Actions (639904; A)

#### DR-REQ-347986/A-FMEM - DCGM Fault

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - DCGM Fault** | **ID**  DR-REQ-347986 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the DCGM status message is missing or "Faulty" (DcChrgRdy\_D\_Stat = 0xF), the BECM will stop charging and go to "Not Ready" (BattChrgRdyStat\_D\_Actl = 0x0).

#### REQ-359296/A-FMEM - BECM Charge Wait Time Out for digital communication

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - BECM Charge Wait Time Out for digital communication** | **ID**  REQ-359296 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140301\_Traction Battery | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the BECM Charge Status is “Charge Wait” and the charger input power mode is “Digital Comm Detected”, “AC Digital” or “DC Charge” for more than 240 seconds (calibratable), it will transition to “Not Ready” and set the BECM Charge Sustain to 0.

*Rationale/Notes*

*System conditions may cause the BCCM to remain in a “Not Ready” state when the BECM is in Charge Wait (e.g. the vehicle is not in park). In these cases, the BECM must be able to abort the charge sequence and shut down in order to prevent draining the 12V battery.*

*For a digital communication charge event, this time out must be increased to allow for the worst case delay in digital communication between the DCGM and the EVSE.*

## DR-REQ-221997/A-DC Fast Charge End Charging Requirements

|  |  |  |
| --- | --- | --- |
| **Title**  **DC Fast Charge End Charging Requirements** | **ID**  DR-REQ-221997 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  140304\_Traction Battery Charger | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-209498/C-DC Fast Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iMf1lqrFx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The BCCM shall end DC Fast Charging if any of the following conditions are true:

1. Any conditions to end conductive charging in DR-REQ-140446 are true.

OR

1. The DCGM charge ready status is “Not Ready” OR “Charge Complete” OR “EVSE Fault” OR “Faulty” (DcChrgRdy\_D\_Stat = 0x1, 0x6, 0xA, 0xF)

OR

1. The BCCM receives a hard button unlock request from the CSI

OR

1. The BCCM receives a soft button unlock request from the APIM (ChrgCordUnlock\_B\_Rq = 0x1 “Request”).

*Rationale/Notes*

*DC Fast charging follows the normal requirements for conductive charging, with some additional restraints such as ending charging via cord unlock.*

# HLFR\_PIC\_DRs\_to\_Body\_Ctrls

## DR-REQ-140521/B-Prevention of Gear Shifting on Plug

|  |  |  |
| --- | --- | --- |
| **Title**  **Prevention of Gear Shifting on Plug** | **ID**  DR-REQ-140521 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  191001\_Body Control Module | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links**  DR-REQ-344076/A-FMEM - Arbitrated Plug Status Missing Message for BCM[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=T4WxmcJcx3NrTD)] | |
| **Verified By Test Method(s)** | | |

**Description**

**Prevent Gear Shifting on Plug**

The BCM shall disable the BTSI signal to the shift module (BrkTrnShifLck\_B\_Stat = 0x0) if the arbitrated plug status signal from the HPCM/PCM is “On Plug” (PlgActvArb\_B\_Actl = 0x1).

If the signal is missing, the default value in the BCM for this signal will be plugged in.

*Notes/Rationale:*

*Input:*

* *PlgActvArb\_B\_Actl*

*Output*

* *Brake Shift Interlock Control (BrkTrnShifLck\_B\_Stat)*

*Initially, value in the BCM will be initialized to on plug until a valid signal is received. This is based on reviews with the BTSI team and his discussions with the transmission team.*

### DR-REQ-344076/A-FMEM - Arbitrated Plug Status Missing Message for BCM

|  |  |  |
| --- | --- | --- |
| **Title**  **FMEM - Arbitrated Plug Status Missing Message for BCM** | **ID**  DR-REQ-344076 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  191001\_Body Control Module | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140521/B-Prevention of Gear Shifting on Plug[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i$axmcJcx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

If the Arbitrated Plug Status is Missing, the BCM shall assume it as “On Plug” (PlgActvArb\_B\_Actl = 0x1) for purposes of setting the BTSI (See DR-REQ-140521)

*Rationale/Notes:*

*In order to prevent the vehicle from shifting out of park while on plug, the BCM must assume the vehicle is on plug if the Arbitrated Status is missing.*

## DR-REQ-193484/A-CAN Request for Secure Cord Unlock - BCM

|  |  |  |
| --- | --- | --- |
| **Title**  **CAN Request for Secure Cord Unlock - BCM** | **ID**  DR-REQ-193484 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  191001\_Body Control Module | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-258010/B-AC Charging Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i7UpXf4Ax3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**CAN Request for Secure Cord Unlock – BCM**

When a CAN message for a Secure Cord Unlock is received from the charger the BCM shall send a message to the charger indicating that a cord unlock is authorized if the following conditions are true:

1. The vehicle doors are unlocked

OR

1. A key fob search has been initiated and a valid key fob has been detected within range of the vehicle

The BCM shall also send a valid security key in response to the challenge code sent by the BCCM.

*Note: Due to security it was recommended that the search area be limited to the Inlet Port external area, if the car is unlocked someone can press the unlock charge cord button and unlock the cord set.*

*The algorithm is defined in the BCM Charge Port Function Spec.*

*The signals sent by the BCM responding to the challenge code are as follows:*

* *ChrgCordResp1\_No\_Actl*
  + *MSB of the response code from the BCM to unlock the charge port*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordResp2\_No\_Actl*
  + *LSB of the response code from the BCM to unlock the charge port*
  + *Size: 8 bits*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *Domain: 0-255*
* *ChrgCordLck\_B\_Stat*
  + *Unlock status of the charge port*
  + *Size: 1 bit*
  + *Rate:*
  + *Tx: BCM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *States*
    - *0x0 – NULL*
    - *0x1 – UNLOCK*

*Additionally, the challenge code and response is based on the vehicle’s VIN number (VehicleGGCCData) per the BCM Charge Port Function Spec.*

# HLFR\_PIC\_DRs\_to\_Telematics\_Controls

# HLFR\_PIC\_DRs\_To\_Driver\_Information\_Module

## DR-REQ-140522/A-Cluster Indication - Charging Mode

|  |  |  |
| --- | --- | --- |
| **Title**  **Cluster Indication - Charging Mode** | **ID**  DR-REQ-140522 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Customer Indication – Charging Mode**

The Cluster shall display a “charging type” message when the Charger Input Power Mode (ChrgrInPwMde\_D\_Actl) from the BCCM is AC, DC, or Inductive Charging.

*Rationale/Notes*

*The cluster should display the charging type based the status of* *ChrgrInPwMde\_D\_Actl*

* *0x0 – EVSE Not Detected*
* *0x1 – EVSE Paused*
* *0x2 – Digital Comm Detected*
* *0x3 – AC Basic*
* *0x4 – AC Digital*
* *0x5 – DC Charging*
* *0x6 – Inductive Charging*
* *0x7 – EVSE Not Compatible*
* *0x8 – EVSE Faulty*

*No icon should be displayed if the charging type is EVSE Not Detected.*

## DR-REQ-234396/A-Cluster Indication - On Plug Tell-tale

|  |  |  |
| --- | --- | --- |
| **Title**  **Cluster Indication - On Plug Tell-tale** | **ID**  DR-REQ-234396 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Customer Indication – On Plug Tell-tale**

The Cluster shall display an icon or tell-tale when the Arbitrated Plug Status (PlgActvArb\_B\_Actl) from the HPCM is ON PLUG. If the signal is missing, the cluster shall default to OFF PLUG.

*Rationale/Notes*

*The cluster should display the charging type based the status of PlgActtvArb\_B\_Actl*

* *0x0: OFF PLUG*
* *0x1: ON PLUG*

*The cluster will not display an icon if the arbitrated plug status is “Off Plug”*

## DR-REQ-140523/A-Cluster Indication - Unplug Vehicle

|  |  |  |
| --- | --- | --- |
| **Title**  **Cluster Indication - Unplug Vehicle** | **ID**  DR-REQ-140523 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137807/D-Drive Away While on Charge[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=iXnB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Cluster Indication – Unplug Vehicle**

The instrument cluster shall display the "Unplug Vehicle to Start"

or equivalent messages based on the input provided by the BCM.

*Notes/Rationale*

*See HLFR\_DIDC SR-REQ-012987 for details on the unplug vehicle to start message*

## DR-REQ-271048/B-EVSE Not Compatible - Cluster Notification

|  |  |  |
| --- | --- | --- |
| **Title**  **EVSE Not Compatible - Cluster Notification** | **ID**  DR-REQ-271048 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-137808/C-Types of Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i8QxmyXVx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

When the Charger Status Display signal is “EVSE Not Compatible” (ChrgStat\_D2\_Dsply = 0x3), and the vehicle is keyed on into Accessory or Run mode, the cluster shall display a popup notification to the cluster indicating that the current EVSE is not capable of charging the vehicle.

*Rationale/Notes*

*The cluster serves as a way of notifying the customer of an incompatible EVSE, but the customer must turn the vehicle on to see it.*

## DR-REQ-271049/B-EVSE Faulty - Cluster Notification

|  |  |  |
| --- | --- | --- |
| **Title**  **EVSE Faulty - Cluster Notification** | **ID**  DR-REQ-271049 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-137808/C-Types of Charging[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i8QxmyXVx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

When the External Charge Fault Display signal is “Yes” (ExtChrgrFalt\_B\_Dsply = 0x1), and the vehicle is keyed on into Accessory or Run mode, the cluster shall display a popup notification to the cluster indicating that there was an external charge station fault.

*Rationale/Notes*

*The cluster serves as a way of notifying the customer of a faulted EVSE, but the customer must turn the vehicle on to see it.*

*The CSI will also display a unique External Fault LED pattern to give the customer an initial indication of the problem. See CSI HLF for details.*

## DR-REQ-140559/A-Cluster Message - Plug Override

|  |  |  |
| --- | --- | --- |
| **Title**  **Cluster Message - Plug Override** | **ID**  DR-REQ-140559 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  130101\_Driver Information Module (Instrument Cluster) | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-140557/C-Plug Status Override[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=TQuB38H7x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Cluster Message – Plug Override**

The instrument cluster shall display a message and provide a feedback option to the customer that enables the customer to confirm the vehicle is unplugged from the wall based on the VSC input. The cluster will send the feedback in the Plug Override Start Command signal to the HPCM.

This signal shall include the following states:

* Null State (no customer response)
* Customer response indicating the vehicle is plugged in (don't over-ride plug status)
* Customer response indicating the vehicle is not plugged in (over-ride plug status)

Signal Definition

Signal Name: PlgOvrrdStrt\_D\_Cmd

Size: 2 bits

Values:

* 0x0 – Null
* 0x1 – Don’t Override Plug Status
* 0x2 – Override Plug Status
* 0x3 – Not used

Resolution: Discrete

Rate: 1000 msec EP

Tx: IPC

Rx: HPCM

# HLFR\_PIC\_DRs\_to\_Infotainment\_Controls

## DR-REQ-213392/A-Unlocking Cord Set - Center Stack Soft Button

|  |  |  |
| --- | --- | --- |
| **Title**  **Unlocking Cord Set - Center Stack Soft Button** | **ID**  DR-REQ-213392 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  150102\_Center Stack Display | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-193480/B-Cord Lock/Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=CwVxX5Lsx3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

**Unlocking Cord Set – Center Stack Soft Button**

The APIM shall include a “soft button” on the touch display that, when pushed, commands the BCCM to unlock the charge cord via a CAN signal.

*Rationale/Notes*

*The BCCM will still authenticate with the BCM for a valid key fob or doors unlocked if it gets an APIM unlock request. The algorithm is defined in the BCM Charge Port Function Spec.*

*Signal:*

* *ChrgCordUnlock\_B\_Rq*
  + *APIM Unlock Request*
  + *Size: 1 bit*
  + *Rate: 1000 EP*
  + *Tx: APIM*
  + *Rx: BCCM*
  + *Initial Value: 0*
  + *States*
    - *0x0 – No Request*
    - *0x1 – Request*

## DR-REQ-271247/B-AC Cord Lock - APIM Enable

|  |  |  |
| --- | --- | --- |
| **Title**  **AC Cord Lock - APIM Enable** | **ID**  DR-REQ-271247 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  150102\_Center Stack Display | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  DR-REQ-258010/B-AC Charging Unlock Requirements[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=i7UpXf4Ax3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

~~In North American Markets, the APIM shall include a screen to allow the customer to enable or disable AC Cord Lock. It shall send a signal to the BCCM saying if AC Cord Lock is Enabled or Disabled.~~

~~Signal Definition~~

~~Signal Name: ChrgCrdLckEnbl\_B\_Stat~~

~~Size: 1 bit~~

~~Values:~~

* ~~0x0 – Not Enabled~~
* ~~0x1 – Enabled~~

~~Rate: 1000 ms E/P~~

~~Tx: APIM~~

~~Rx: BCCM~~

*Rationale/Notes:*

*This requirement is currently not being implemented*

## DR-REQ-333361/A-Cord Lock Fault Alert - Center Stack Display

|  |  |  |
| --- | --- | --- |
| **Title**  **Cord Lock Fault Alert - Center Stack Display** | **ID**  DR-REQ-333361 | **Revision**  A  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  150102\_Center Stack Display | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  BEV Single Motor Transmission [BEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], PHEV Power Split Transmission [PHEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links** | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The APIM Center Stack shall display a cord unlock fault popup based on the cord unlock fault signal (ChrgCrdLck\_D\_Falt) from the BCCM according to the following table:

|  |  |
| --- | --- |
| ChrgCrdLck\_D\_Falt State | Popup to display |
| 0x0 NoFault | No popup |
| 0x1 CsiFault | “Unlock button failure. Press Close to unlock” |
| 0x2 HardwareFault | “Cord lock system failure. See owner’s manual” |

When the customer closes the “Unlock button failure. Press Close to unlock” popup, the APIM shall send a charge cord unlock request (ChrgCrdUnlock\_B\_Rq = 0x1) to the BCCM (See DR-REQ-213392 for signal details).

*Rationale/Notes*

*If the charge cord unlock system fails, the customer may be unable to unlock their charge cord and thus unable to drive their vehicle. The charge cord unlock fault popup exists to guide the customer to an alternative unlock method in the event that the hard unlock button fails.*

# HLFR\_PIC\_DRs\_to\_SSFT2\_Starting\_Electrical\_Accessory\_PT\_Functions

## DR-REQ-213756/B-LV Energy Transfer on Charge

|  |  |  |
| --- | --- | --- |
| **Title**  **LV Energy Transfer on Charge** | **ID**  DR-REQ-213756 | **Revision**  B  **Status**  Frozen |
| **Meets** | | |
| **Applies To**  SSFT 2\_Starting Electrical Accessory PT Functions | |  |
| **Legacy ID** | | |
| **Vehicle Configuration**  PHEV Power Split Transmission [PHEV], Modular Hybrid Transmission PHEV [MHT\_PHEV], BEV Single Motor Transmission [BEV] | | |
| **Rationale** | | |
| **Notes** | | |
| **Up-Links**  SR-REQ-137814/A-12V Battery Support On Plug[[VSEM](https://www.vsemweb.ford.com/tc/launchapp?-attach=true&-s=226TCSession&-o=BraVw6x1x3NrTD)] | **Down-Links** | |
| **Verified By Test Method(s)** | | |

**Description**

The HPCM/PCM shall support the 12V battery while on plug per the LVSM HLF (298474 – HLFR\_LVSP)

***Rationale/Notes***

*The PCM/HPCM is responsible for requesting the activation of the DCDC converter. The 12V battery does need to be maintained while on plug, but the details are all covered in the Low Voltage Setpoint Maintenance HLF.*

# Revision History (200554; A)

# Appendix Section (200555; A)