

## Charging Complaints - Initial analysis- BR213 Plug-In and newer

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|-------------------|------------------------------------------------|
| Topic number      | LI54.10-P-066316                               |
| Version           | 1                                              |
| Design group      | 54.10 Battery, power supply, voltage converter |
| Date              | 05-31-2017                                     |
| Validity          | All plug-in hybrids                            |
| Reason for change |                                                |
| Reason for block  |                                                |

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### Complaint:

- Charging inoperative
- Charging aborted
- Fault messages (flash codes) on charging cable box (ICCU)
- Fault messages (flash codes) on charging socket on vehicle
- Questions associated with charging process

### Cause:

Faults that occur during the charging process and aborted charging can have different root causes. Affected components may include:

- Infrastructure
- Charging cable with box (ICCU)
- Charging Socket
- On-Board Charger (OBL)
- HV Battery or vehicle control (internal)

For exact fault analysis and fault rectification please reference the points made in the Remedy section below. Also reference the appendices (A1, A2, B1 & B2) below.

For each customer complaint, it is essential that the customer is asked about the related conditions below and that the customer's charging infrastructure is examined.

- Which Charging Mode was being used?
- What Charging Cable / Charger was being used (i.e. Brand, Color, Age, Physical Appearance/Condition, Voltage)?

### Remedy:

A) A flash code with red LED on the charging cable box (ICCU) is shown

After inserting the charging cable a self-test is run first. After the test, if one of the two upper LEDs (AC LED and/or CCIC LED) lights up in red or if they flash on and off, a malfunction is present.

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=> Please use appendices A1& A2 in the appendices to help with interpretation of the possible reasons for the charging fault and diagnostic flash codes.

=> Rectify the fault in accordance with the details given in "Fault Reason / Recommended Actions" in appendix A2.

B) A flash code on the vehicle's charging socket is displayed.

The charging socket on the vehicle always indicates each operating condition (Charging, vehicle unlocked, fault etc.) through two LEDs.

=> Please use appendices B1& B2 in this TIPS document to interpret the reason for the LED display

=> If a fault is found, rectify it in accordance with the details given in "Possible Errors / Possible Remedy" in appendix B2.

C) Fault without flash code or remedies under A+B would not serve any purpose

- Read out quick test, actual values and control unit event log data (from on-board charger & HV battery)
- Please answer the following questions as accurately as possible
- Then create a PTSS case with the above and below information

1. Exact description of the complaint? \_\_\_\_\_

2. When did the complaint first occur? Date/Time: \_\_\_\_\_

3. Is the complaint reproducible? Yes / No

3.1 Under which conditions does the complaint occur?

Outside temperature \_\_\_\_\_ °C/°F

Service Life \_\_\_\_\_ Hours / Days

Weather \_\_\_\_\_ Wet / Dry

Other \_\_\_\_\_

4. If the vehicle is charging, has the charging period changed in any way compared with an earlier period?

Exact description of change compared with earlier period:

Before the fault occurred: Charging time \_\_\_\_\_ hours for SOC (= State of Charge) from \_\_\_\_\_% to \_\_\_\_\_%

Currently: Charging time \_\_\_\_\_ hours for SOC (= State of Charge) from \_\_\_\_\_% to \_\_\_\_\_%

5. At which SOC was charging started when the fault occurred? \_\_\_\_\_%

6. Does the charging process always terminate after a specific period of time? No / Yes, after a charging time of : \_\_\_\_\_ min / hr

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7. Does the charging process always terminate at a specific SOC? No/yes, when the following SOC is reached:  
\_\_\_\_\_ %

8. Describe the charging infrastructure used and the specific charge levels

|                                        | Charging | Not charging |          | Manufacturer                |
|----------------------------------------|----------|--------------|----------|-----------------------------|
|                                        |          | Connection   | Internet |                             |
|                                        |          | Present?     |          |                             |
| Wallbox:                               | _____    | _____        | _____    | _____                       |
| Domestic outlet (with GFI):            | _____    | _____        | _____    | Mains fused with 12/16/32 A |
| Domestic outlet (without GFI):         | _____    | _____        | _____    | Mains fused with 12/16/32 A |
| Public charging (with Plug&Charge):    | _____    | _____        | _____    | _____                       |
| Public charging (without Plug&Charge): | _____    | _____        | _____    | _____                       |

Payment type for public charging: RFID / phone / SMS / credit card / other: \_\_\_\_\_

9. Which charging cable or which load mode is used?

Manufacturer: \_\_\_\_\_ Charging cable designation/part number: \_\_\_\_\_

Mode 2 (in USA: "Level 1") \_\_\_\_\_

Mode 3 (3.3 kW: in USA "Level 2") \_\_\_\_\_

Mode 3 (22 kW) \_\_\_\_\_

10. What happens when charging is performed with another charging cable?

Same fault profile \_\_\_\_\_ (Yes / No)

Different fault profile, accurate description: \_\_\_\_\_

11. Do other vehicles in the charging infrastructure exhibit identical charging problems? Yes / No

Description: \_\_\_\_\_

12a. What does the indicator lamp at top left on the vehicle charging socket do in a fault case?

(It describes the status "charging cable inserted"; see also appendices B1 & B2)

White \_\_\_\_\_ Stays off \_\_\_\_\_

Comment: \_\_\_\_\_

12b. What does the indicator lamp at top right on the vehicle charging socket do in a fault case?

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(it describes the "Charging status"; see also appendices B1 & B2)

Green flashing\_\_\_\_ Green\_\_\_\_ Orange\_\_\_\_ Orange flashing\_\_\_\_ Red (fast flashing)\_\_\_\_

Comment:\_\_\_\_\_

13. Which flash code is shown on the charging cable box (ICCU) (see also appendices A1 & A2) \_\_\_\_

14. In which charging mode does the complaint occur?

"Charging now"\_\_\_\_ Departure time "w/o AC on" \_\_\_\_ Departure time with "AC on"\_\_\_\_

15. Which charging current is configured for the vehicle?

Charging current for vehicle: 6A\_\_\_\_ 8A\_\_\_\_ 10A\_\_\_\_ 12A\_\_\_\_

16. Visual inspection/ assessment of charging cable?

Assessment:\_\_\_\_\_

17. More complaints / information?

Description:\_\_\_\_\_

| Attachments                                                                                   |                                                                                                   |
|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| File                                                                                          | Description                                                                                       |
| DEUTSCH_A1_Beschreibung der Anzeigeelemente und Funktion der Ladekontrollbox (ICCU).pdf       | GERMAN_A1_Description of indicator lights and function of the in-cable control unit (ICCU)        |
| ENGLISH_A1_Description of indicator lights and funct. of the in-cable control unit (ICCU).pdf | ENGLISH_A1_Description of indicator lights and function of the in-cable control unit (ICCU)       |
| DEUTSCH_A2_Tabelle zur Interpretation der Blinksignale der Ladekontrollbox.pdf                | GERMAN_A2_Table for interpretation of flash signals of the in-cable control unit                  |
| ENGLISH_A2_Table to interpret the flash signals of the in-cable control unit (ICCU).pdf       | ENGLISH_A2_Table for interpretation of flash signals of the in-cable control unit (ICCU)          |
| DEUTSCH_ENGLISH_B1.pdf                                                                        | GERMAN_ENGLISH_B1_Description of the charging socket LEDs_Description of the charging socket LEDs |
| DEUTSCH_B2_Flussdiagramm zur Analyse der Leuchtsignale der Ladedose.pdf                       | GERMAN_B2_Flow chart for interpretation of the flash signals of the charging socket               |
| ENGLISH_B2_Flowchart to interpret the flash-signals of the charging socket.pdf                | ENGLISH_B2_Flow chart for interpretation of the flash signals of the charging socket.pdf          |

| Symptoms                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------|
| Overall vehicle / Power supply / Battery/On-board electrical system / Battery function / Battery cannot be charged |
| Power generation / Engine management / Function / Nonfunctional                                                    |
| Overall vehicle / Power supply / High-voltage on-board electrical system / High-voltage battery / Nonfunctional    |

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|                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Domestic power outlet (Mode2/Level1) / Does not start                      |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Domestic power outlet (Mode2/Level1) / Aborts                              |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Wallbox (Mode3/Level2) / Does not start                                    |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Wallbox (Mode3/Level2) / Aborts                                            |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Charging pillar (Mode3/Level2) / Does not start                            |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Charging pillar (Mode3/Level2) / Aborts                                    |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / smartCharging / Does not start                                             |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / smartCharging / Aborts                                                     |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Charging cable / Nonfunctional                                             |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Charging cable / Light indicators on charge monitoring box permanently off |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Charging cable / Flash code (red) on charge monitoring box                 |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Charging socket / Lock does not close                                      |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Charging socket / Lock does not open                                       |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Charging socket / White LED lights up                                      |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Charging socket / Red LED lights up                                        |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Charging socket / Orange LED lights up                                     |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Charging socket / Green LED lights up                                      |
| Overall vehicle / Power supply / High-voltage on-board electrical system / Charging / Charging socket / LED nonfunctional                                        |

## Appendix A1

# User Guide for Fault Diagnostics Mode Mode 2 / Level 1 Charging lead

### 1. Fault Diagnostics Mode

**Step 1:** Enter into Fault Diagnostics Mode by pushing button (more than 5 sec) when system is in fault state (Fault LED will start blinking once user entered in Fault Diagnostics Mode).

**Step 2:** Press button (normal/one push) to display the respective LED sequence for the fault present in the system.

**Example:** For "RCD TRIPPED Fault", 12A Red and 16A Red LED will set to ON, remaining LED's will be OFF (see figure below).

**Step 3:** Upon next push, LED sequence will change for the next fault present in the system.

**Step 4:** System can exit the Fault Diagnostics Mode only by power reset (unplug cable from wall outlet).



Push button (more than 5 sec) when system is in fault state to enter into Fault Diagnostics Mode

## Appendix A2 - Page 1

| No. | Fault Type                                     | Charge LEDs Pattern |    |     |     |     | Fault Reason                                                                                                                        | Recommended Action                                                                                                                                                                                                          |
|-----|------------------------------------------------|---------------------|----|-----|-----|-----|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                                                | 6A                  | 8A | 10A | 12A | 16A |                                                                                                                                     |                                                                                                                                                                                                                             |
| 1   | ICCB Failure                                   |                     |    |     |     |     | Internal Failure                                                                                                                    | 1- Cordset Power Off -> On and check again. If Problem persists, replace charging cable                                                                                                                                     |
| 2   | RCD TRIPPED Fault (Leakage Current)            |                     |    |     |     |     | Leakage Current exceeds 20 mA (ECE) and 30 mA (SAE) for more than 5 sec                                                             | 1- Check the leakage and possible short on vehicle side.<br>2- Check different charging lead                                                                                                                                |
| 3   | Main Contactor Relay Fault                     |                     |    |     |     |     | Main contactor diagnostic fails                                                                                                     | 1- Cordset Power Off -> On and check again. If Problem persists, replace charging cable                                                                                                                                     |
| 4   | FAULT-Indicator (LED) Fault                    |                     |    |     |     |     | Fault LED diagnostic fails                                                                                                          | 1- Cordset Power Off -> On and check again. If Problem persists, replace charging cable                                                                                                                                     |
| 5   | PE Disconnection fault                         |                     |    |     |     |     | Disconnection of PE line                                                                                                            | 1- Check PE line connection on infrastructure side<br><b>Note:</b> This function is only available for ULok variant                                                                                                         |
| 6   | Ampacity Mismatch Fault                        |                     |    |     |     |     | Calibration Fault                                                                                                                   | 1- Cordset Power Off -> On and check again. If Problem persists, replace charging cable                                                                                                                                     |
| 7   | Calibration Factor Fault                       |                     |    |     |     |     |                                                                                                                                     |                                                                                                                                                                                                                             |
| 8   | Checksum Mismatch Fault                        |                     |    |     |     |     | Calculated checksum for code is mismatched with checksum stored in FLASH                                                            | 1- Cordset Power Off -> On and check again. If problem persists product replacement will required                                                                                                                           |
| 9   | Software State Manager Fault                   |                     |    |     |     |     | State Manager logic failure                                                                                                         | 1- Cordset Power Off -> On and check again. If problem persists product replacement will required                                                                                                                           |
| 10  | RCD Diagnostics Fault                          |                     |    |     |     |     | RCD diagnostic fail                                                                                                                 | 1- Cordset Power Off -> On and check again. If problem persists product replacement will required                                                                                                                           |
| 11  | ADC SELFTEST Fault                             |                     |    |     |     |     | ADC channel selftest failure                                                                                                        | 1- Cordset Power Off -> On and check again. If problem persists product replacement will required<br><b>Note:</b> This function is not available for China and Singapore variant                                            |
| 12  | Control Pilot State-D Fault                    |                     |    |     |     |     | Control Pilot is in false State                                                                                                     | 1- Check the CP interface connector on vehicle/cordset side.<br>2- Check the PWM signal on vehicle/cordset side.                                                                                                            |
| 13  | Control Pilot INVALID State Fault              |                     |    |     |     |     | Control Pilot voltage is Invalid or Main Contractor Fault                                                                           | 1- Check the CP interface connector on vehicle/cordset side.<br>2- Check the PWM signal on vehicle/cordset side.                                                                                                            |
| 14  | Control Pilot PWM ( Duty Cycle Mismatch) Fault |                     |    |     |     |     | Control Pilot set duty cycle and feedback duty cycle mismatch                                                                       | 1- Cordset Power Off -> On and check again. If problem persists product replacement will required                                                                                                                           |
| 15  | SPI Fault (Driver Error)                       |                     |    |     |     |     | SPI measuring IC communication error on cordset side.                                                                               | 1- Cordset Power Off -> On and check again. If problem persists product replacement will required                                                                                                                           |
| 16  | SPI Voltage Offset Fault                       |                     |    |     |     |     | Voltage offset error                                                                                                                | 1- Check the Supply line disturbance/fluctuations.<br>2- If Problem persists, replace charging cable                                                                                                                        |
| 17  | SPI Current Offset Fault                       |                     |    |     |     |     | Current offset                                                                                                                      | 1- Check the Supply line disturbance/fluctuations.<br>2- If Problem persists, replace charging cable                                                                                                                        |
| 18  | Total Current Fault ( Over Current )           |                     |    |     |     |     | Total current > 125% of selected charge current for > 15 sec.<br>Total current > 120 - 125% of selected charge current for > 25 sec | 1- Check for vehicle side current draw.                                                                                                                                                                                     |
| 19  | Under Voltage Fault                            |                     |    |     |     |     | Supply Voltage is < 80V with Hysteresis of 10V                                                                                      | 1- Check infrastructure side supply voltage                                                                                                                                                                                 |
| 20  | Over Voltage Fault                             |                     |    |     |     |     | Supply Voltage is > 271 V with Hysteresis of 4.1V                                                                                   | 1- Check infrastructure side supply voltage                                                                                                                                                                                 |
| 21  | DP ( Domestic Plug) Temperature Sensor Fault   |                     |    |     |     |     | Temperature difference between sensor 1 and sensor 2 of Domestic Plug > 15°C for 200sec.                                            | 1- Cordset Power Off and wait for a while (to cool down)<br>2- Cordset Power On and check again. If Problem persists, replace charging cable<br><b>Note:</b> This function is not available for China and Singapore variant |

## Appendix A2 - Page 2

|    |                                                       |  |  |  |  |                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                              |
|----|-------------------------------------------------------|--|--|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 22 | ICCB Temperature Sensor Drift Fault                   |  |  |  |  | Temperature value drift between ICCB sensor 1 and sensor 2 is > 15°C for 3sec.                                                                                                                                               | 1- Cordset Power Off, wait for a while (to cool down)<br>2- Cordset Power On and check again. If Problem persists, replace charging cable.                                                                                                                                                                   |
| 23 | Over Temperature / Under Temperature Fault            |  |  |  |  | ICCB temperature is > 80°C or ICCB / DP temperature is below -40°C                                                                                                                                                           | 1- Cordset Power Off, wait for a while (to cool down or warm up)<br>2- Cordset Power On and check again. If Problem persists, replace charging cable.<br>3- Please make sure that the plug inserted to the socket outlet correctly.<br>Note: This function is not available for China and Singapore variant. |
| 24 | Flash Read Write Fault                                |  |  |  |  | cordset FLASH data mismatch                                                                                                                                                                                                  | 1- Cordset Power Off -> On and check again. If problem persists product replacement will required                                                                                                                                                                                                            |
| 25 | Control Pilot Negative Voltage Fault                  |  |  |  |  | Control Pilot PWM -12 volt negative level missing                                                                                                                                                                            | 1- Check the CP interface connector on vehicle/cordset side.<br>2- Check the PWM signal on vehicle/cordset side.                                                                                                                                                                                             |
| 26 | ICCB Temperature Sensor 1 Open / Short Fault          |  |  |  |  | ICCB temperature sensor 1 open or short circuited ( <b>also if temperature is &gt; 150°C or &lt; -55°C</b> ).<br><b>Note</b> : In case of open/short externally through pin, ADC SelfTest fault will also occur within 1sec. | 1- Cordset Power Off -> On and check again. If Problem persists, replace charging cable                                                                                                                                                                                                                      |
| 27 | ICCB Temperature Sensor 2 Open / Short Fault          |  |  |  |  | ICCB temperature sensor 2 open or short circuited ( <b>if temperature is &gt; 150°C or &lt; -55°C</b> ).<br><b>Note</b> : In case of open/short externally through pin, ADC SelfTest fault will also occur within 1sec.      | 1- Cordset Power Off -> On and check again. If Problem persists, replace charging cable                                                                                                                                                                                                                      |
| 28 | Domestic Plug Temperature Sensor 1 Open / Short Fault |  |  |  |  | DP temperature sensor 1 open or short circuited ( <b>if temperature is &gt; 150°C or &lt; -55°C</b> ).<br><b>Note</b> : In case of open/short externally through pin, ADC SelfTest fault will also occur within 1sec.        | 1- Cordset Power Off -> On and check again. If Problem persists, replace charging cable                                                                                                                                                                                                                      |
| 29 | Domestic Plug Temperature Sensor 2 Open / Short Fault |  |  |  |  | DP temperature sensor 2 open or short circuited ( <b>if temperature is &gt; 150°C or &lt; -55°C</b> ).<br><b>Note</b> : In case of open/short externally through pin, ADC SelfTest fault will also occur within 1sec.        | 1- Cordset Power Off -> On and check again. If Problem persists, replace charging cable                                                                                                                                                                                                                      |
| 30 | Measuring IC Halt Fault                               |  |  |  |  | On cordset side, Measuring IC is stuck temporarily.                                                                                                                                                                          | 1- Cordset Power Off -> On and check again. If Problem persists, replace charging cable                                                                                                                                                                                                                      |
| 31 | Measuring IC Configuration Fault                      |  |  |  |  | On cordset side, Measuring IC configuration fault                                                                                                                                                                            | 1- Cordset Power Off -> On and check again. If Problem persists, replace charging cable                                                                                                                                                                                                                      |

IC = Integrated Circuit

ICCB = In Cable Control Box

LED = Light Emitting Diode

RCD = Residual Current Device

PE = Protected Earth

ADC = Analog to Digital Converter

SPI = Serial Peripheral Interface

PWM = Pulse Width Modulation

IC = Integrated Circuit

ECE = United Nations Economic Commission for Europe

SAE = Society of Automotive Engineers (North america)

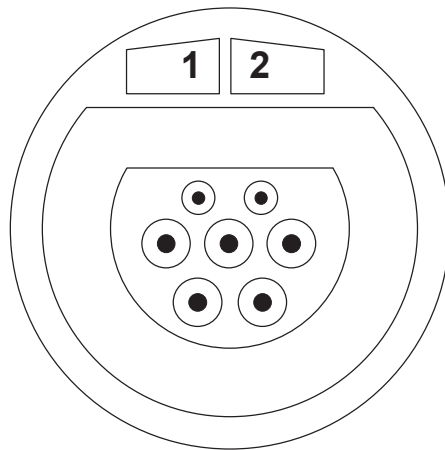
## Appendix B1

# Identification of the charging socket LED's

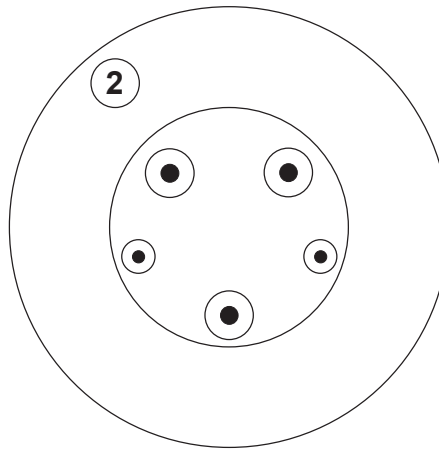
1 = Kontrollleuchte  
"Ladekabel gesteckt" /  
Control LED "charging  
cable plugged"

2 = Kontrollleuchte  
"Ladestatus" / Control  
LED "status of charge"

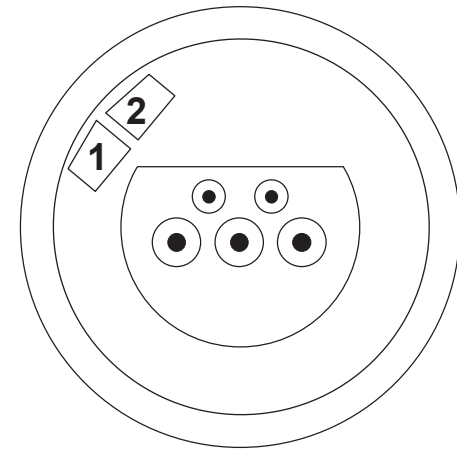
ECE Version



SAE Version



China Version



# Appendix B2

