# P21CA00 And Other Power Faults Leading To Communication Faults And SCR Inducement (Derate)

## Background

It is possible that a progressive loss of electrical power to the Aftertreatment Control Module (ACM) will result in the ACM cutting power to the Exhaust Aftertreatment System (EATS) sensors – NOx, Particulate Matter (PM) and DEF Quality, Level and Temperature sensor. This triggers communication faults for these sensors and ultimately puts the system into SCR Inducement. The root cause is often related to loss of power or battery voltage and/or grounding issues. The instruction below describes the most likely causes and provides steps for troubleshooting.

## Symptoms

- Presence of P21CA along with other ACM power and communication faults P220A, P220B, P24D0, U029D, U029E, U02A2, U02A3, P0562.
- SCR inducement and/or derate.

| | |
|---|---|
| P21CA00 | Reductant Control Module Supply Voltage |
| P220A1C | NOx Sensor Supply Voltage Circuit (Bank 1 Sensor 1) |
| P220B1C | NOx Sensor Supply Voltage Circuit (Bank 1 Sensor 2) |
| P24D000 | Particulate Matter Sensor Supply Voltage Circuit Low |
| U029D00 | Lost Communication With NOx Sensor "A" |
| U029E00 | Lost Communication With NOx Sensor "B" |
| U02A200 | Lost Communication with Reductant Quality Module |
| U02A300 | Lost Communication With PM Sensor |
| P056200 | ECU Battery Potential Below Range |

This pattern of codes indicates that there are issues with the ACM power supply or ground connections. Typically, this combination develops over time as a connection deteriorates. Eventually the effective voltage to the ACM drops below 8V and there is insufficient power to support the sensors controlled by the ACM - NOx, PM and DEF level/temp sensors. Communication is lost to these devices.

Once sensor communication codes (U029D, U029E, U02A2) are triggered, the truck will go into SCR Inducement followed by derate.

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| IMPORTANT |
| --- |
| **Presence of any combinations of P24D0, P21CA, P0562, generally does NOT indicate the ACM is 'bad' or a PM sensor is 'bad'.** |

## Required Tools

| Part Number | Description | Quantity |
| --- | --- | --- |
| 9998699 | Break-Out Box | 1 |
| 9990014 | 62-Pin ACM Connector Harness | 1 |
| 88890074 (or equivalent) | Multimeter | 1 |

## Initial Checks

This combination of faults is frequently caused by a loose or faulty connection on battery power or ground (but not fully disconnected - if fully disconnected, DTCs U116F and U010E would also be present).

- **Check that ALL the ACM power and ground connections are securely tightened.**

  - Ensure battery nuts are tightened to 15 lb-ft (20 Nm). If nuts are loose, replace nuts with **PN 25153442**. Positive connections will also require red protective boot **PN 20831182**.

  - Ensure multiple ring terminals on a common stud are fanned out and lying flat against each other.

  - Ensure ring terminals and other contact points are clean and free from any terminal protectant coating or wax.

- **If there is no evidence of loose battery connections:** Continue to the checks below.

## Other items to check

### 1. Check the battery condition as follows:

#### 1.1. Check the complete battery pack voltage.

**1.1.1.** Start the truck.

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**1.1.2.** Run the engine at fast idle (1000 RPM) for 1 minute.

**1.1.3.** Turn the truck off, then return the key to the ON position.

**1.1.4.** Check voltage with all of the batteries still connected to one another.

- All battery positive terminals are connected together by busbars or cables, and all battery negative terminals are connected together.

**1.1.5. Make a note of the voltage and evaluate results:**

- For a fully charged system, in good condition, the voltage should be 12.4 - 12.6V for standard flooded lead-acid batteries, or 12.6 - 12.8V for AGM-type batteries.

- Low battery voltage is indicative of an inadequate charging system

  - Potential causes include corroded cables, dirty connections and/or weak or defective batteries.

**1.2. Check individual battery condition.**

**1.2.1.** Disconnect the busbars and cables.

**1.2.2.** Inspect and clean all interconnecting terminals. Ensure there is no corrosion.

**1.2.3.** Check each battery voltage and perform a load test on each battery individually.

**1.2.4. Evaluate results:**

- **If one battery's voltage is significantly lower than the others, or lower than the measurement from Step 1.1.5, OR fails a load test:** The battery may be bad or there may be a connection issue such as excessive corrosion on the busbar or terminal, inhibiting proper charging.

**1.2.5.** Replace or clean any corroded part as needed.

Live UI **1.2.6.** Reconnect the busbars and/or cables.

**1.3. Check the battery pack voltage while charging system is active.**

**1.3.1.** Start the truck.

**1.3.2.** Run the engine at fast idle (1000 RPM) for 1 minute.

**1.3.3.** With the engine still running, recheck battery voltage:

- Voltage should rise to 13.5-14.5V rapidly.

- **If the voltage is less than 13V:** Run then engine for an additional minute and recheck, as the batteries may have been deeply discharged.

**1.3.4. Evaluate results:**

- **If the voltage remains less than 13V:** There is an issue with the alternator or the alternator belt.

- If the alternator belt is in good condition, there is an issue with the alternator.

**If there are no issues found from the checks above or the code(s) continue to log after the steps above are followed, normal diagnostic steps should be followed in Premium Tech Tool.**

Tags

p21ca00 p220a1c p220b1c p24d000

u029d00 u029e00 u02a200 u02a300

p056200 p21ca-00 p220a-1c u02a3-00

p0562-00 acm power eats datalink p220b-1c

p24d0-00 u029d-00 u029e-00 u02a2-00

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