**LFEV-Y5-2017**

v1

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VSCADA/CAN Bus ICD

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This document describes how the CAN Bus worked in the LFEV car.

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**Fall**

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# Overview

The CAN Bus network is used to talk between all sensors and VSCADA. Devices jabber on the network with each sensor having a unique ID. VSCADA accepts sensor packets and decodes the raw bytes into useful values. The largest ID can be 0x7FF.

# Hardware interface

There are 2 hardware connection options; a 6-pin and a 9-pin connector. These are documented in the appendix. Any traces on a PCB should be 120 ohms and differentially routed. The cable should be twisted pair.

# ID allocation and respective sensor, byte length, unit and subsystem

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Description | Address | Offset | ByteLength | System | Units |
| Pack 1 state | 0x100 | 0 | 1 | TSV |   |
| Pack 1 voltage | 0x100 | 1 | 2 | TSV | V |
| Pack 1 current | 0x100 | 3 | 4 | TSV | A |
| Pack 1 SOC | 0x100 | 7 | 1 | TSV | % |
| Pack 1 Coulombs | 0x101 | 0 | 4 | TSV |   |
| Pack 1 cell status 1 | 0x101 | 4 | 1 | TSV |   |
| Pack 1 cell status 2 | 0x101 | 5 | 1 | TSV |   |
| Pack 1 cell status 3 | 0x101 | 6 | 1 | TSV |   |
| Pack 1 cell status 4 | 0x101 | 7 | 1 | TSV |   |
| Pack 1 cell status 5 | 0x102 | 0 | 1 | TSV |   |
| Pack 1 cell status 6 | 0x102 | 1 | 1 | TSV |   |
| Pack 1 cell status 7 | 0x102 | 2 | 1 | TSV |   |
| Pack 1 cell voltage 1 | 0x102 | 3 | 2 | TSV | V |
| Pack 1 cell voltage 2 | 0x102 | 5 | 2 | TSV | V |
| Pack 1 cell voltage 3 | 0x103 | 0 | 2 | TSV | V |
| Pack 1 cell voltage 4 | 0x103 | 2 | 2 | TSV | V |
| Pack 1 cell voltage 5 | 0x103 | 4 | 2 | TSV | V |
| Pack 1 cell voltage 6 | 0x103 | 6 | 2 | TSV | V |
| Pack 1 cell voltage 7 | 0x104 | 0 | 2 | TSV | V |
| Pack 1 cell temp 1 | 0x104 | 2 | 2 | TSV | C |
| Pack 1 cell temp 2 | 0x104 | 4 | 2 | TSV | C |
| Pack 1 cell temp 3 | 0x104 | 6 | 2 | TSV | C |
| Pack 1 cell temp 4 | 0x105 | 0 | 2 | TSV | C |
| Pack 1 cell temp 5 | 0x105 | 2 | 2 | TSV | C |
| Pack 1 cell temp 6 | 0x105 | 4 | 2 | TSV | C |
| Pack 1 cell temp 7 | 0x105 | 6 | 2 | TSV | C |
| Pack 2 state | 0x200 | 0 | 1 | TSV |   |
| Pack 2 voltage | 0x200 | 1 | 2 | TSV | V |
| Pack 2 current | 0x200 | 3 | 4 | TSV | A |
| Pack 2 SOC | 0x200 | 7 | 1 | TSV | % |
| Pack 2 Coulombs | 0x201 | 0 | 4 | TSV |   |
| Pack 2 cell status 1 | 0x201 | 4 | 1 | TSV |   |
| Pack 2 cell status 2 | 0x201 | 5 | 1 | TSV |   |
| Pack 2 cell status 3 | 0x201 | 6 | 1 | TSV |   |
| Pack 2 cell status 4 | 0x201 | 7 | 1 | TSV |   |
| Pack 2 cell status 5 | 0x202 | 0 | 1 | TSV |   |
| Pack 2 cell status 6 | 0x202 | 1 | 1 | TSV |   |
| Pack 2 cell status 7 | 0x202 | 2 | 1 | TSV |   |
| Pack 2 cell voltage 1 | 0x202 | 3 | 2 | TSV | V |
| Pack 2 cell voltage 2 | 0x202 | 5 | 2 | TSV | V |
| Pack 2 cell voltage 3 | 0x203 | 0 | 2 | TSV | V |
| Pack 2 cell voltage 4 | 0x203 | 2 | 2 | TSV | V |
| Pack 2 cell voltage 5 | 0x203 | 4 | 2 | TSV | V |
| Pack 2 cell voltage 6 | 0x203 | 6 | 2 | TSV | V |
| Pack 2 cell voltage 7 | 0x204 | 0 | 2 | TSV | V |
| Pack 2 cell temp 1 | 0x204 | 2 | 2 | TSV | C |
| Pack 2 cell temp 2 | 0x204 | 4 | 2 | TSV | C |
| Pack 2 cell temp 3 | 0x204 | 6 | 2 | TSV | C |
| Pack 2 cell temp 4 | 0x205 | 0 | 2 | TSV | C |
| Pack 2 cell temp 5 | 0x205 | 2 | 2 | TSV | C |
| Pack 2 cell temp 6 | 0x205 | 4 | 2 | TSV | C |
| Pack 2 cell temp 7 | 0x205 | 6 | 2 | TSV | C |
| Pack 3 state | 0x300 | 0 | 1 | TSV |   |
| Pack 3 voltage | 0x300 | 1 | 2 | TSV | V |
| Pack 3 current | 0x300 | 3 | 4 | TSV | A |
| Pack 3 SOC | 0x300 | 7 | 1 | TSV | % |
| Pack 3 Coulombs | 0x301 | 0 | 4 | TSV |   |
| Pack 3 cell status 1 | 0x301 | 4 | 1 | TSV |   |
| Pack 3 cell status 2 | 0x301 | 5 | 1 | TSV |   |
| Pack 3 cell status 3 | 0x301 | 6 | 1 | TSV |   |
| Pack 3 cell status 4 | 0x301 | 7 | 1 | TSV |   |
| Pack 3 cell status 5 | 0x302 | 0 | 1 | TSV |   |
| Pack 3 cell status 6 | 0x302 | 1 | 1 | TSV |   |
| Pack 3 cell status 7 | 0x302 | 2 | 1 | TSV |   |
| Pack 3 cell voltage 1 | 0x302 | 3 | 2 | TSV | V |
| Pack 3 cell voltage 2 | 0x302 | 5 | 2 | TSV | V |
| Pack 3 cell voltage 3 | 0x303 | 0 | 2 | TSV | V |
| Pack 3 cell voltage 4 | 0x303 | 2 | 2 | TSV | V |
| Pack 3 cell voltage 5 | 0x303 | 4 | 2 | TSV | V |
| Pack 3 cell voltage 6 | 0x303 | 6 | 2 | TSV | V |
| Pack 3 cell voltage 7 | 0x304 | 0 | 2 | TSV | V |
| Pack 3 cell temp 1 | 0x304 | 2 | 2 | TSV | C |
| Pack 3 cell temp 2 | 0x304 | 4 | 2 | TSV | C |
| Pack 3 cell temp 3 | 0x304 | 6 | 2 | TSV | C |
| Pack 3 cell temp 4 | 0x305 | 0 | 2 | TSV | C |
| Pack 3 cell temp 5 | 0x305 | 2 | 2 | TSV | C |
| Pack 3 cell temp 6 | 0x305 | 4 | 2 | TSV | C |
| Pack 3 cell temp 7 | 0x305 | 6 | 2 | TSV | C |
| Pack 4 state | 0x400 | 0 | 1 | TSV |   |
| Pack 4 voltage | 0x400 | 1 | 2 | TSV | V |
| Pack 4 current | 0x400 | 3 | 4 | TSV | A |
| Pack 4 SOC | 0x400 | 7 | 1 | TSV | % |
| Pack 4 Coulombs | 0x401 | 0 | 4 | TSV |   |
| Pack 4 cell status 1 | 0x401 | 4 | 1 | TSV |   |
| Pack 4 cell status 2 | 0x401 | 5 | 1 | TSV |   |
| Pack 4 cell status 3 | 0x401 | 6 | 1 | TSV |   |
| Pack 4 cell status 4 | 0x401 | 7 | 1 | TSV |   |
| Pack 4 cell status 5 | 0x402 | 0 | 1 | TSV |   |
| Pack 4 cell status 6 | 0x402 | 1 | 1 | TSV |   |
| Pack 4 cell status 7 | 0x402 | 2 | 1 | TSV |   |
| Pack 4 cell voltage 1 | 0x402 | 3 | 2 | TSV | V |
| Pack 4 cell voltage 2 | 0x402 | 5 | 2 | TSV | V |
| Pack 4 cell voltage 3 | 0x403 | 0 | 2 | TSV | V |
| Pack 4 cell voltage 4 | 0x403 | 2 | 2 | TSV | V |
| Pack 4 cell voltage 5 | 0x403 | 4 | 2 | TSV | V |
| Pack 4 cell voltage 6 | 0x403 | 6 | 2 | TSV | V |
| Pack 4 cell voltage 7 | 0x404 | 0 | 2 | TSV | V |
| Pack 4 cell temp 1 | 0x404 | 2 | 2 | TSV | C |
| Pack 4 cell temp 2 | 0x404 | 4 | 2 | TSV | C |
| Pack 4 cell temp 3 | 0x404 | 6 | 2 | TSV | C |
| Pack 4 cell temp 4 | 0x405 | 0 | 2 | TSV | C |
| Pack 4 cell temp 5 | 0x405 | 2 | 2 | TSV | C |
| Pack 4 cell temp 6 | 0x405 | 4 | 2 | TSV | C |
| Pack 4 cell temp 7 | 0x405 | 6 | 2 | TSV | C |
| Motor RPM | 0x601 | 0 | 2 | DYNO | RPM |
| Motor Temp | 0x601 | 2 | 1 | DYNO | C |
| Controller Temp | 0x601 | 3 | 1 | DYNO | C |
| RMS Current | 0x601 | 4 | 2 | DYNO | A |
| Capacitor Voltage | 0x601 | 6 | 2 | DYNO | V |
| Stator Frequency | 0x602 | 0 | 2 | DYNO | HZ |
| Controller Fault Primary | 0x602 | 2 | 1 | DYNO |   |
| Controller Fault Secondary | 0x602 | 3 | 1 | DYNO |   |
| Throttle Input | 0x602 | 4 | 1 | DYNO | % |
| Brake Input | 0x602 | 5 | 1 | DYNO | % |
| Cooling state | 0xF0 | 0 | 2 | COOLING |   |
| Outlet Fluid Temp | 0xF0 | 2 | 4 | COOLING | C |
| Fluid Flow Rate | 0xF1 | 0 | 4 | COOLING |   |
| Inlet Fluid Temp | 0xF1 | 4 | 4 | COOLING | C |
| TSI state | 0xF2 | 0 | 3 | TSI |   |
| IMD | 0xF2 | 3 | 4 | TSI |   |
| Brake | 0xF3 | 0 | 5 | TSI |   |
| Throttle position | 0xF4 | 0 | 6 | TSI |   |
| TSV Voltage | 0xF5 | 0 | 7 | TSI |   |
| TSV Current | 0xF6 | 0 | 8 | TSI |   |

### Data packet formats

Each CAN packet contains data from multiple sensors. The first buffer has offset zero. Sensor values that span multiple bytes transmit the most significant bytes first. Subsequent sensor values follow, with an offset as noted in the table above.

An example packet is shown in the table below:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Buffer(7) | 6 | 5 | 4 | 3 | 2 | 1 | Buffer(0) |
| 0x100 | Pack 1 State | Pack 1 voltage MSB | Pack 1 Voltage LSB | Pack 1 Current [31:34] | Pack 1 Current [23:16] | Pack 1 Current [15:8] | Pack 1 Current [7:0] | Pack SOC |

# Appendix A - Hardware Interfaces

## 6 pin connector

