Indigo Webinar

Heavy-Duty Vehicle Diagnostics (J1939) with Indigo
Agenda

1. Introduction to Indigo
2. Introduction to J1939
3. J1939 Diagnostics
4. J1939 Features in Indigo
Introduction to Indigo

Indigo – Intelligent Diagnostic Test System

- **Self-configuring**
  Indigo is a self-configuring Diagnostic Test System. It uses database semantic information, reads ECU information and applies heuristics to configure the diagnostic capabilities and the behavior of the tester.

- **Use-case driven**
  Indigo is a use-case driven Diagnostic Test System. It addresses the daily diagnostic tasks with specialized use-case views.

- **Vehicle oriented**
  Indigo is a vehicle oriented Diagnostic Test System. It allows to view and modify vehicle-wide parameters and serves as a starting point to dive into the ECUs.
Tester Configuration
Introduction to Indigo

Tester Configuration

Scenario

► Quickly setup your tester

Solution

► Suitable default setup - starting point for most common diagnostic tasks
  > Fault Memory
  > Identification Data
  > Measure
  > Parameterize

► Simple configuration – execution of further diagnostic task
  > Adapt window configuration as needed

► Restricted “Sealed Mode”
  > Secure sharing of data and configuration (encrypted)

► Pack&Go
  > Share self-containing configurations with your colleagues or development partners
Vehicle Identification

Scenario

► Direct access to vehicle identification data

Solution

► Quick insight in vehicle to get vehicle identification overview
  > SW version, HW supplier, ...
► Direct presentation of identified ECU variants
Introduction to Indigo

Fault Memory

Scenario
- Immediate overview over the whole vehicle’s DTCs
- Dive into the ECUs - check fault memory information in detail

Solution
- Well arranged overview of the complete vehicle’s ECUs and their fault memory status
- Detailed DTC data for single ECU
  - Confirmed DTCs & Status
  - Environment data & Error conditions
Introduction to Indigo

Vehicle Data Access

Scenario

► Quick access to a specific set of vehicle data

Solution

► Easily arrange parameters from several ECUs - merged in one view
► Read-before-write: when writing a subset of service parameters, read dependent parameters before
► Store/Restore parameter values
► Measure values - manually or periodically
► Symbolic logging of selected values
Introduction to Indigo

On-Board Diagnostics

Scenario

► Access OBD information from an ECU or a vehicle

Solution

► Read OBD fault memory and freeze frame data
► Read vehicle identification
► Measure OBD powertrain diagnostic data
► Access OBD monitoring test results
► Generic access to all OBD services and parameters of an ECU or vehicle
► Build-in support for OBD-II (SAE J1979/ISO15031) and WWH-OBD (ISO27145)
Introduction to Indigo

Reports

Scenario

▶ Store diagnostic analysis results for presentation and archiving

Solution

▶ Extensive Indigo reports

  ▶ Well-structured overview in PDF and HTML format

  ▶ Reports are prepared for printing

  ▶ Configurable report layout – conform to corporate requirements

  ▶ Designed to be adaptable by user: flexible and inexpensive

Fault Memory Overview

Text: Vector Indigo 4.2 SP3
Author: vslab
Date: 2016-03-22 17:20:54
Project: C:\Users\Public\Documents\Vector\indigo\4.2\Demo\CAN\Demo.indigo
Report: C:\Users\vslab\Desktop\20160322_172054_Report_FaultMemoryOverview.pdf

DTC Overview

<table>
<thead>
<tr>
<th>DTC Code</th>
<th>DTC Text</th>
<th>WI</th>
<th>NCM</th>
<th>FCL</th>
<th>NCC</th>
<th>C</th>
<th>P</th>
<th>FC</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>P001011</td>
<td>&quot;Y&quot; Camshaft Position Actuator Circuit short to ground</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>P00161C</td>
<td>Camshaft Position - Camshaft Position Correlation S1 - circuit voltage out of range</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td></td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>P001722</td>
<td>Camshaft Position - Camshaft Position Correlation S2 - signal amplitude &gt; maximum</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>P013511</td>
<td>O2 Sensor Heater Circuit - circuit short to ground</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>P011001</td>
<td>Intake Air Temperature Sensor 1 Circuit - signal amplitude &lt; minimum</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>P013002</td>
<td>O2 Sensor Circuit - signal amplitude &gt; maximum</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Snapshot Data Records

P001031

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTCSnapshotRecordNumber</td>
<td>0xd0</td>
</tr>
<tr>
<td>DTCSnapshotRecordNumberOfIdentifiers</td>
<td>0xd0</td>
</tr>
<tr>
<td>SnapshotRecord</td>
<td>DataRecord</td>
</tr>
<tr>
<td>Odometer of first DTC setting</td>
<td>64256 km</td>
</tr>
<tr>
<td>Odometer of last DTC setting</td>
<td>65424 km</td>
</tr>
<tr>
<td>Frequency counter</td>
<td>58</td>
</tr>
<tr>
<td>Cycle of operation counter</td>
<td>151</td>
</tr>
</tbody>
</table>

P00161C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTCSnapshotRecordNumber</td>
<td>0xd0</td>
</tr>
<tr>
<td>DTCSnapshotRecordNumberOfIdentifiers</td>
<td>0xd0</td>
</tr>
<tr>
<td>SnapshotRecord</td>
<td>DataRecord</td>
</tr>
<tr>
<td>Odometer of first DTC setting</td>
<td>49760 km</td>
</tr>
<tr>
<td>Odometer of last DTC setting</td>
<td>65424 km</td>
</tr>
<tr>
<td>Frequency counter</td>
<td>167</td>
</tr>
<tr>
<td>Cycle of operation counter</td>
<td>145</td>
</tr>
</tbody>
</table>
Introduction to Indigo

Automation of Diagnostic Sequences

Scenario

► Extend diagnostic capabilities of Indigo
► Automate recurring diagnostic tasks

Solution

► Vector Diagnostic Scripting Library
  > Create diagnostic sequences using C# (.NET)
  > Build-in script recorder
  > User interaction with dialogs, input validation, ...
  > Compatible with CANoe/CANape

```csharp
using System.Collections.Generic;
using System.Threading;
using Vector.Diagnostics;
using Vector.Tools;
using Vector.Scripting;
using Vector.Scripting.UI;

/// <Summary>
/// Script 'OpenWindowFrontLeft' automatically generated on 2013-12-12, 14:09:29 by Vector Indigo
/// </Summary>
public class OpenWindowFrontLeft
{
    public void OpenWindowFrontLeftScript()
    {
        Ecu BodyControlModule = Application.GetEcu("BodyControlModule");
        // Check if ECU exists
        if (BodyControlModule == null)
        {
            Output.WriteLine("The ECU 'BodyControlModule' does not exist. Please check the configuration.");
            return;
        }

        // <Summary>
        // Service: WindowControlling_Start (Signature: 0x31 01 00 40)
        // </Summary>
        {
            using (Request request = BodyControlModule.CreateRequest("WindowControlling_Start"))
            {
                Parameter Door_Id = request.GetParameter("Door_Id");
                Door_Id.Value.Set("FrontLeft");
                Parameter Control_Type = request.GetParameter("Control_Type");
                Control_Type.Value.Set("Down");
                SendResult result = request.Send();
                if (result.Status == SendStatus.Ok)
                {
                    using (Response response = result.Response)
                    {
                    }
                }
            }
        }
    }
}
```
Introduction to Indigo

Indigo Remote System

Indigo Remote Server
https://remote-diagnostics.de

Internet, UMTS

Vehicle Specialist, Test Driver

Indigo Access Point
Windows-PC

Network-Interface

Indigo Remote
Windows-PC

Diagnostic Expert
Agenda

1. Introduction to Indigo

2. Introduction to J1939

3. J1939 Diagnostics

4. J1939 Features in Indigo
Introduction to J1939

Introduction

- Founded in the USA, defined by Society of Automotive Engineers (SAE)

- Uniform perspective and uniform handling of most common vehicle components of various vehicle types and manufacturers

- Difference in heavy duty vehicle markets
  - USA
    - vehicle buyers prescribe OEM which components they need to install in specific vehicles
  - Europe
    - OEMs fully define the design of the entire vehicle (incl. component + config)

- Ideally: interconnect individual J1939 components based on plug & play

- Standardization vs. OEM specific extensions of the communication
Introduction to J1939

Particular Characteristics of J1939

- Extended CAN Identifier (29 Bit)
- Bit rate: 250kBaud
- Peer-to-peer and broadcast communication
- Transport protocols for up to 1785 data bytes
- Network management
- Definition of parameter groups for commercial vehicles and others
- Manufacturer specific parameter groups are supported
- Diagnostic features
Several standards based on J1939

- **ISO11783 - Tractors and machinery for agriculture and forestry**
  - Communication between tractor and implements on an implement bus
  - Extended transport protocol and working set management

- **NMEA2000 – Serial data networking of marine electronic devices**
  - Parameter groups for communication between marine devices
  - Fast Packet transport protocol

- **ISO11992 – Interchange of digital information between towing and towed vehicle**
  - Same parameter group format as J1939
  - Different physical layer with 125kBaud

- **FMS – Fleet Management System**
  - Gateway between J1939 and fleet management system
# ISO/OSI Layers Model

<table>
<thead>
<tr>
<th>ISO/OSI Layer</th>
<th>Related J1939 document</th>
</tr>
</thead>
</table>
| 7 Application | J1939/7X: Application Layer  
                    J1939/71: Common application  
                    J1939/72: Virtual Terminal  
                    J1939/73: Diagnostics |
| 3 Network Layer | J1939/31: Bridge, Router, Gateway |
| 2 Data Link Layer | J1939/21: Transport Protocols |
| 1 Physical Layer | J1939/1X: Physical Layer  
                     J1939/11: 250Kbps, Twisted Shielded Pair  
                     J1939/13: Diagnostic Plug |
Types of Communication

- Point-to-Point
  - One target address
  - Examples
    - Device configuration
    - ECU commands

- Broadcast
  - All bus nodes
  - Examples
    - Sending measured values
    - Error handling
    - Diagnostic purposes
Device Names

- J1939 defines Device Names by a 64-bit number
- Identify the device and its functionality if ECU is switched to active in the plug & play network

<table>
<thead>
<tr>
<th>Byte 8</th>
<th>Byte 7</th>
<th>Byte 6</th>
<th>Byte 5</th>
<th>Byte 4</th>
<th>Byte 3</th>
<th>Byte 2</th>
<th>Byte 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3 Bit</td>
<td>4 Bit</td>
<td>7 Bit</td>
<td>1</td>
<td>8 Bit</td>
<td>5 Bit</td>
<td>3 Bit</td>
</tr>
<tr>
<td>11 Bit</td>
<td>21 Bit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>A</th>
<th>C</th>
<th>G</th>
<th>VSI</th>
<th>Vehicle System</th>
<th>r</th>
<th>Function</th>
<th>Function Instance</th>
<th>ECU</th>
<th>Manufacturer Code</th>
<th>Identity Number</th>
</tr>
</thead>
</table>

AAC: Arbitrary Address Capable
IG: Industry Group
VSI: Vehicle System Instance
r: reserved
ECUI: ECU Instance
Logical Address

- J1939 defined 8-bit addresses for the individual vehicle components
  - Heavy Duty: no change over the lifetime of the component
  - Agriculture / marine industries: dynamical negotiation based on the device name

- Address Ranges
  - 0..127: Engines, Transmission, Retarder, Brakes,..
  - 128..247: Agriculture / marine equipment
  - 248..253: Service tools, OBD scanners
  - 254: Null Address
  - 255: Broadcast
Introduction to J1939

Network Management

- Address Claim without conflict
Introduction to J1939

Network Management

- Address Claim with conflict AAC not set:

```
SD AddressClaim_Conflict_AAC_NotSet

ECU 1
AddressClaim(SA = 20, NAME B)
AddressClaim(SA = 20, NAME A)
AddressClaim(SA = 254, NAME B)
Shutdown()

ECU 2

Network

Priority:
NAME A > NAME B
```

Source Address 0xFE = Null Address
Address Claim with conflict and AAC set:

Priority:
NAME A > NAME B
Parameter Groups

- Set of parameters
  - Belonging to the same topic
  - Sharing the same transmission rate
Suspect Parameter Number (SPN)

- SPN is assigned to each parameter of a parameter group or component
- Used for diagnostic purpose
- Identify abnormal operation of a controller application

### SPN 190
- **Name**: Engine Speed
- **Description**: Actual engine speed which ...
- **SLOT ID (Scaling, Limit, Offset and Transfer Function)**: 76
- **Length**: 2 Byte
- **Unit**: Rpm
- **Resolution**: 0,125 rpm per bit
- **Offset**: 0
- **Range**: 0 to 8031,875 rpm
Introduction to J1939

Specification of SPNs & PGNs

- CANdb++ for specification of network messages

![CANdb++ screenshot](image-url)
Introduction to J1939

Specification of SPNs & PGNs

» CANdelaStudio as specification tool for diagnostics
Agenda

1. Introduction to Indigo

2. Introduction to J1939

3. J1939 Diagnostics

4. J1939 Features in Indigo
Diagnostic Messages

- Diagnostic Messages according to J1939-73
  - Vehicle maintenance
  - During vehicle operation
    - Report diagnostic information
    - Self-compensate as appropriate, based on information received

- Services
  - Periodically broadcasting active DTCs
  - Identify operator diagnostic lamp status
  - Reading or clearing DTCs
  - Reading or writing control module memory
  - Providing a security function
  - Stop/start message broadcasts
  - Reporting diagnostic readiness
  - Monitoring engine parametric data
  - ...

J1939 Diagnostics
## Fault Memory

<table>
<thead>
<tr>
<th>SAE J1939 Diagnostic Message (DM)</th>
<th>UDS Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM1 – Active DTCs</td>
<td>0x19 02 – Report DTCs by Status</td>
</tr>
<tr>
<td>DM2 – Previously Active DTCs</td>
<td>0x19 02 – Report DTCs by Status</td>
</tr>
<tr>
<td>DM3 – Clear/Reset DTCs</td>
<td>0x14 – Clear DTCs</td>
</tr>
<tr>
<td>DM4 – Freeze Frame Data</td>
<td>0x19 05 – Report Freeze Frame</td>
</tr>
<tr>
<td>DM5 – Diagnostic Readiness</td>
<td>0x19 01 – Report # DTCs by Status</td>
</tr>
<tr>
<td>DM6 – Pending DTCs</td>
<td>0x19 02 – Report DTCs by Status</td>
</tr>
<tr>
<td>DM11 – Diagnostic Data Clear</td>
<td>0x14 – Clear DTCs</td>
</tr>
<tr>
<td>DM12 – Emissions-Related Active DTCs</td>
<td>0x19 42 – Report WWH-OBD DTC by Status</td>
</tr>
<tr>
<td>DM22 – Individual Clear DTCs</td>
<td>0x14 – Clear DTCs</td>
</tr>
<tr>
<td>DM24 – SPN Support</td>
<td>0x19 04 – Read DTC Snapshot Data</td>
</tr>
<tr>
<td>DM25 – Expanded Freeze Frames</td>
<td>0x19 04 – Read DTC Snapshot Data</td>
</tr>
<tr>
<td>DM27 – All Pending DTCs</td>
<td>0x19 02 – Report DTCs by Status</td>
</tr>
<tr>
<td>DM28 – Permanent DTCs</td>
<td>-</td>
</tr>
<tr>
<td>DM29 – DTC Counts</td>
<td>0x19 01 – Report # DTCs by Status</td>
</tr>
</tbody>
</table>
J1939 Diagnostics

Fault Memory: J1939

- 4 different malfunction indicator lights
  - Malfunction Indicator Lamp
  - Red Stop Lamp
  - Amber Warning Lamp
  - Protect Lamp

- DTC Format

<table>
<thead>
<tr>
<th>DTC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Byte 1</strong></td>
</tr>
<tr>
<td><strong>Low Byte SPN</strong></td>
</tr>
<tr>
<td>MSB ← → LSB</td>
</tr>
<tr>
<td><strong>Byte 2</strong></td>
</tr>
<tr>
<td><strong>Mid Byte SPN</strong></td>
</tr>
<tr>
<td>MSB ← → LSB</td>
</tr>
<tr>
<td><strong>Byte 3</strong></td>
</tr>
<tr>
<td>3 MSB of SPN + FMI</td>
</tr>
<tr>
<td><strong>Byte 4</strong></td>
</tr>
<tr>
<td>Conversion Method + Occurrence Count</td>
</tr>
<tr>
<td><strong>SPN</strong></td>
</tr>
<tr>
<td>8 7 6 5 4 3 2 1</td>
</tr>
<tr>
<td><strong>FMI</strong></td>
</tr>
<tr>
<td>8 7 6 5 4 3 2 1</td>
</tr>
<tr>
<td><strong>CM</strong></td>
</tr>
<tr>
<td>8 7 6 5 4 3 2 1</td>
</tr>
<tr>
<td><strong>OC</strong></td>
</tr>
<tr>
<td>8 7 6 5 4 3 2 1</td>
</tr>
</tbody>
</table>
J1939 Features in Indigo

J1939 DTC Auditor: Fault Memory Overview

- Comprehensive overview to all connected ECUs with fault memory state
- Allows clearing fault memory for all ECUs
- Extensive Reporting (PDF / HTML)
J1939 Features in Indigo

J1939 DTC Auditor: Fault Memory Overview

- J1939 DTC Auditor
J1939 Features in Indigo

J1939 DTC Browser: ECU Fault Memory Overview

► Detailed display of ECU fault memory
  ► SPN, FMI, OC, DTC status information, warning lamp indication, ...

► Access DTC freeze frames with one click

► Clear fault memory of a single ECU

► Extensive reporting in PDF or HTML format
## J1939 DTC Browser: ECU Fault Memory Overview

### J1939 DTC Browser

![J1939 DTC Browser](image)

**SPN** | **FMI** | **OC** | **Active** | **Passive** | **Pending** | **MIL** | **RSL** | **AWL** | **PTC**
--- | --- | --- | --- | --- | --- | --- | --- | --- | ---
1119: Engine Actual Exhaust Oxygen | 11: Root Cause Not Known | 1 | X | X | | On | | | |
110: Engine Coolant Temperature | 11: Root Cause Not Known | 1 | | X | | | | | |

**Freeze Frame Data**

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPN</td>
<td>Engine Actual Exhaust Oxygen (1119)</td>
</tr>
<tr>
<td>FMI</td>
<td>Root Cause Not Known (11)</td>
</tr>
<tr>
<td>OC</td>
<td>1</td>
</tr>
<tr>
<td>Engine Torque Mode</td>
<td></td>
</tr>
<tr>
<td>Boost</td>
<td>0kPa</td>
</tr>
<tr>
<td>Engine Speed</td>
<td>0rpm</td>
</tr>
<tr>
<td>Engine % Load</td>
<td>0%</td>
</tr>
<tr>
<td>Engine Coolant Temperature</td>
<td>-40°C</td>
</tr>
<tr>
<td>Vehicle Speed</td>
<td>0kph</td>
</tr>
</tbody>
</table>
J1939 Features in Indigo

J1939 Diagnostic Console for Generic Access

- Send any Diagnostic Message to an ECU and evaluate responses
J1939 Features in Indigo

Live Data: Measure Data

- Measure SPN/PGN data cyclically
- Correlate J1939 SPN data with KWP/UDS parameter values from CDD/ODX or CAN signals from DBC
- Display minimum and maximum values per parameter
- Define minimum and maximum thresholds for parameter values
- Extensive logging of symbolic data
- Graphical display of signal values (via Graphical Live Data)
J1939 Features in Indigo

Live Data: Measure Data

- Live Data

![Live Data: Measure Data](image-url)
J1939 Features in Indigo

Live Data: Measure Data

- Automatic selection of SPNs / PGNs during measurement
J1939 Features in Indigo

OBD ECU Information

- Display discovered OBD ECUs
  - Name of the ECU
  - Logical Address
  - Calibration IDs (CalID)
  - Calibration Verification Numbers (CVN)

- Display vehicle information
  - VIN + Manufacturer
  - Fuel Type
  - OBD Compliance
J1939 Features in Indigo

OBD ECU Information

![OBD Vehicle Info Screen]

- **VIN:** VECTOR2006-07-11X
- **Manufacturer:** Vector CanTech
- **Fuel Type:** Diesel
- **OBD Type:** OBD and OBD II

**ECU Data**

- **Engine**
  - **Vector 1:** 33685760

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J1939 Features in Indigo

OBD Monitoring Status

- Display vehicle readiness
  - MIL
  - Number of emission related DTCs

- Distance since DTCs activated / cleared
  - Travel Time since DTCs activated / cleared

- Monitoring Status since DTCs cleared
  - Monitoring Status this driving cycle
J1939 Features in Indigo

OBD Monitoring Status

OBD Vehicle Status

J1939 Malfunction Indicator Light (MIL)

- MIL Status: On
- Travel Distance: 21760km
- Travel Time: 16min

Monitoring Status

<table>
<thead>
<tr>
<th>Monitor Name</th>
<th>Monitor Status Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Misfire Monitor</td>
<td>Test not supported</td>
</tr>
<tr>
<td>Fuel System Monitor</td>
<td>Test not supported</td>
</tr>
<tr>
<td>Comprehensive Component Monitor</td>
<td>Test not supported</td>
</tr>
<tr>
<td>Catalyst Monitor</td>
<td>Test not supported</td>
</tr>
<tr>
<td>Heated Catalyst Monitor</td>
<td>Test not supported</td>
</tr>
<tr>
<td>Evaporative System Monitor</td>
<td>Test not supported</td>
</tr>
<tr>
<td>Secondary Air System Monitor</td>
<td>Test not supported</td>
</tr>
<tr>
<td>A/C System Refrigerant Monitor</td>
<td>Test not supported</td>
</tr>
<tr>
<td>Exhaust Gas Sensor Monitor</td>
<td>Test not supported</td>
</tr>
<tr>
<td>Exhaust Gas Sensor Heater Monitor</td>
<td>Test not supported</td>
</tr>
<tr>
<td>EGR/VVT System Monitor</td>
<td>Test not supported</td>
</tr>
<tr>
<td>Cold Start Aid System Monitor</td>
<td>Test not supported</td>
</tr>
<tr>
<td>Boost Pressure Control System Monitor</td>
<td>Test not supported</td>
</tr>
<tr>
<td>Diesel Particulate Filter (DPF) Monitor</td>
<td>Test not supported</td>
</tr>
</tbody>
</table>
OBD Fault Memory

- Access OBD relevant DTCs
  - ECU that stored the emission related DTC
  - Suspect Parameter Number (SPN)
  - FMI
  - DTC severity (Class A, Class B1, Class B2, Class C)
  - DTC status (pending, previously active, confirmed)

- Access DTC Environment Data
OBD Fault Memory

J1939 Malfunction Indicator Light (MIL)

- Current: On
- Since MIL activated: 21760km
- Since Clear: 1km

Travel Distance: 1km

Fault Memory Overview

<table>
<thead>
<tr>
<th>ECU</th>
<th>SPN</th>
<th>FMI</th>
<th>A, Confirmed and Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine</td>
<td>Engine Coolant Temperature (110)</td>
<td>Root Cause Not Known</td>
<td>x</td>
</tr>
</tbody>
</table>
OBD In-Use Monitoring Performance Ratio

- Access In-Use Monitoring Performance Ratios (IUMPR) for each monitor
  - Conditions encountered count
  - Completion count
  - Automatic calculation of the ratio

- Extensive reporting in PDF and HTML
## J1939 Features in Indigo

### OBD In-Use Monitoring Performance Ratio

The following table shows the OBD vehicle in-use performance tracking:

<table>
<thead>
<tr>
<th>Monitor Name</th>
<th>Completion</th>
<th>Cond. Encountered</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalyst Bank 1 System Monitor</td>
<td>10</td>
<td>170</td>
<td>0.06</td>
</tr>
<tr>
<td>Engine Evaporative System Monitor</td>
<td>12</td>
<td>173</td>
<td>0.07</td>
</tr>
</tbody>
</table>
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