#### **Table Of Contents**

#### Introduction

#### **Chapter 1: Introduction to On-Board Diagnostics**

Closed-Loop Feedback Systems

**Pre-OBD Emissions Requirements** 

Automotive On-Board Diagnostics

Proprietary OBD: 1980-1987

OBD-I

OBD-I.5

**OBD-II** 

Has OBD Made a Difference?

## **Chapter 2: OBD-II Standardization**

The Power of the Microchip

**Evolution of Automotive Networks** 

Standardized ALDL Connector

Standardized Scan Tool Data

Diagnostic Trouble Codes

The MIL

Frame-to-Frame Data

Real-Time Data

What Information Does OBD-II Provide?

SAE Standards versus ISO Standards

## **Chapter 3: The OBD-II Data Interface**

Data Link Connector

Determining if the Vehicle is OBD-II

**OBD-II Data Protocols** 

Serial Communications Protocols

Troubleshooting Common DLC Connection Problems

### **Chapter 4: Scan Tool Interfaces**

Generic OBD-II Scan Tool

Manufacturer-Specific OBD-II Scan Tool

Reading Scan Data

**OBD-II Trouble Code Reader** 

Entry-Level OBD-II Scan Tool

Professional-Level OBD-II Scan Tool

Personality Keys and Adapters

Manufacturer-Specific OBD-II Scan Tool

Personal-Computer-Based OBD-II Scan Tool

## **Chapter 5: OBD-II Modes**

Mode \$01 – Request Data by Specific PID

Mode \$02 – Request Freeze-Frame Data by Specific PID

Mode \$03 – Request Set Diagnostic Trouble Codes

Mode \$04 – Clear Stored Diagnostic Trouble Codes and Reset MIL

Mode \$05 – Oxygen Sensor Test Results

Mode \$06 – Advanced Diagnostic Mode

Mode \$07 – Request On-Board Monitor Test Results

Mode \$08 – Control Operations of On-Board Systems

Mode \$09 – Vehicle Information

# **Chapter 6: Diagnostic Trouble Codes**

**OBD-II** Drive Cycle

Anatomy of a Diagnostic Trouble Code

Pending Diagnostic Trouble Codes

Diagnostic Trouble Code Types

Current and Historical Diagnostic Trouble Codes

Plan Your Work and Work Your Plan

# **Chapter 7: Freeze-Frame Data**

Freeze-Frame Data Reports

Freeze-Frame Data Summary

Historical Freeze-Frame Data

Breaking Down Freeze-Frame Data

Using the Freeze-Frame Data Example

#### **Chapter 8: Emissions Tests and System Monitors**

**Emissions Tests** 

**System Monitors** 

Misfire Monitor

**Evaporative System Monitor** 

Heated Catalyst Monitor and Catalyst Efficiency Monitor

Secondary Air System Monitor

Fuel System Monitor

Oxygen Sensor Monitor and Heated Oxygen Sensor Monitor

**EGR System Monitor** 

Comprehensive Component Monitor

#### **Chapter 9: Four-Stroke Engine Cycle**

Intake Cycle

Compression Cycle

Combustion Cycle

Exhaust Cycle Otto Cycle Pressure versus Volume

## Chapter 10: OBD-II and the Otto Engine Model

Pressure and Vacuum Supercharging/Turbocharging versus Normally Aspirated Crank, Camshaft and Valves Static versus Dynamic Compression Ratios

# **Chapter 11: Controlling Fuel Systems**

Closed-Loop is the Key
Fuel Combustion and Thermal Efficiency
Volumetric Efficiency
Airflow Volume
What Can Go Wrong?
Evolution of the ECM

## **Chapter 12: Dynamic Fuel Correction**

Fuel Requirements
In a Perfect World
Fuel-Trim Adjustments
Real-Time Fuel-Trim Adjustments
Historical Fuel-Trim Adjustments
DTCs Related to Fuel Trims
P0171 and P0174 DTC Fuel-Trim System Lean
P0172 and P0175 DTC Fuel-Trim System Rich

#### **Chapter 13: Engine Ignition Controls**

What is Ignition Timing?
Generating High Voltage
Distributors
Knowing When to Fire
Controlling the Timing
Sensors that Affect Timing
Detonation and Pre-Ignition
The ECM and Detonation
What Causes Detonation and Pre-Ignition?

### **Chapter 14: Misfires**

Misfire Types
OBD-II Misfire Detection
P030x Misfire DTC
Diagnosing a Misfire

Frame-to-Frame Data Blinking MIL False Misfire Code

## **Chapter 15: Sensors**

Intake Air Temperature Sensor (IAT)
Engine Coolant Temperature Sensor (ECT)
Throttle Position Sensor (TPS)
Camshaft Position Sensor (CMP)
Crankshaft Position Sensor (CKP)
Manifold Absolute Pressure (MAP) Sensor
Mass Air Flow (MAF) Sensor

## **Chapter 16: Oxygen Sensors**

Oxygen Sensors Are Consumable How an Oxygen Sensor Works Diagnosing an Oxygen Sensor Oxygen Sensor Codes What Causes Oxygen Sensor Failure? Replacing an Oxygen Sensor

## **Glossary**

**Appendix A: Using a Volt Ohm Meter** 

Appendix B: Generic OBD-II DTC Codes

Appendix C: Manufacturer-Specific OBD-II DTC Codes