Glossary of Terms for Automotive Scanning Diagnostics, Calibration and Programming

- **(ADAS) Advance Driver Assistance Systems**
  This term is used to describe the many systems and emerging technologies present in the latest model vehicles and has existed in some vehicles as early as 2006. Systems include; Lidar, Radar, sonar, object detection, keep lane assist, blind spot detection, thermal imaging (night vision), brake assist, active cruise control, active lighting etc. these systems use an array of sensors and cameras that require calibrations to operate properly. Some of these systems require targeting set up or road testing procedures for calibrations. Each system and manufacturer has specific procedures for calibrations. Refer to OEM service information for targeting and calibration procedures.

- **Aftermarket scan tool**
  A scan tool that is developed and marketed outside of OEM dealer sources. Aftermarket scan tools can vary from basic to highly complex and specialized. Scan tools functionality is dependent on the software packages developed and purchased for the tool. Some aftermarket scan tools contain advanced procedures and functions for performing advanced engine and emission diagnosis.

- **Application Based Scan Tool (software with communication interface)**
  This is a laptop, PC, or tablet based software package that utilizes the computing resources of the device and is connected to a vehicle via a USB, Blue-Tooth, Wi-Fi, interface (API) (VCI) to a vehicle diagnostic connector. Both OEM and aftermarket scan tools are available in this configuration. Functionality is dependent on the vehicle software level of the application.

- **Battery Support**
  A suitable battery charger, battery voltage maintainer or a fully charged jump box connected to the vehicle while in KOEO mode and is especially critical during programming routines. Important to prevent vehicle voltage levels from falling below normal levels. If normal levels are not maintained diagnostic results are no longer relevant and programming can fail. A special battery maintainer with a “programming” setting is the best tool for this, especially for programming and/or long scanning operations. This tool allows you to maintain a voltage level even under moderate loads with the key on almost indefinitely. A standard charger can introduce voltage fluctuations or over voltage conditions that will interrupt programming or skew diagnostic results. A Jump box provides a nice even voltage level for a longer period than the vehicle battery alone, but it will begin to drop as its charge is depleted. This is a usable method as long as extended programming sessions do not overrun the stored jump box capacity. Note: Refer to Service manual for Hybrid and electric vehicle procedures on battery support.

- **CAN (Controlled Area Network) AKA (ISO 14229-1 Unified Diagnostic Services on CAN)**
  CAN is a vehicle communication protocol that has been replacing older protocols on vehicles for diagnostics and module to module communications since 2003 in vehicles. CAN wiring is primarily a 2-wire communication network connecting modules and a diagnostic connection for a scan tool. As of 2008 all vehicles sold in the US are required to implement CAN as one of their signaling protocols. Today there can be 1 to 4 CAN networks on a vehicle for electronics and diagnostic functions. These include High speed CAN, Medium Speed CAN, Low Speed CAN and Single Wire Can.

- **Calibrate/Initialization**

Calibrating aka Initialization is not programming. It is the process of putting a module into "learn Mode" with predetermined standard set points. Like setting your bathroom scale to "0" before you weigh yourself. Calibrations need to be done whether a module was replaced or not, and if there was a deployment or not. Calibrations are done with a compatible scan tool. All codes and faults must be cleared and confirmed repaired before a calibration is complete. If a module was replaced, module programming may need to be done first. Some examples of this are passenger seat, brake pedal position, steering angle or ADAS calibrations.

- **Coding**
  This is similar to calibration or module set up, but not as detailed as programming. Coding is something that must be entered into modules using a compatible scan tool when a component or module has been replaced or the system reset (Conditional amongst manufacturers). When a vehicle is scanned before collision repairs, existing coding values can be obtained and recorded for re-entry after vehicle repairs. When the vehicle is completed and codes cleared, the module may not recognize replaced or disconnected components that occur during the repair. When this happens the "code" values must be re-entered into the module. If the coding values have not been recorded from the original module, they will have to be obtained from the manufacturer?. This can be time consuming to obtain at times so it is important to record these values before repairs are made.

- **Conditional Monitoring**
  This describes a type of diagnostic code setting that requires a road test. *(this type of monitoring happens for permanent and pending codes)* Certain conditions must be met for the module to run a system function check. Some of these types of DTCs require multiple road tests to set.

- **Continuous Monitoring**
  This is a diagnostic trouble code self-check description. Some circuits and conditions are continuously monitored. Which means a code can be set if a fault is present at any time the key is on or engine running. Many of these codes can be checked for a re-occurrence from a simple key cycle.

- **Cyber Fingerprint**
  Diagnostic Trouble Codes resulting from or created during the normal course of performing the required repair operations. During the repair process disconnection of sensors, lights, modules, wiring and other related diagnostic/electronic/and computer related parts including the disconnection of the battery trigger multiple diagnostic faults codes. These codes create a shop cyber fingerprint which can provide a virtual roadmap of the repairs performed on the vehicle.

- **Data link connector (DLC) AKA OBDII connector**
  This is the point of connection for a scan tool to access vehicle data. A 16-pin connector with pins arranged in two rows of 8, numbered 1 to 8 and 9 to 16. The DLC is D-shaped, and is located within a mandated distance from the driver's steering wheel, usually located just beneath the knee bolster, or in the dash panel area. Some vehicles have an access door or cover over the connector. Some vehicles have a second connector for systems that are proprietary to manufactures or that are non-emissions related. These are usually found on pre-2004 vehicles. And are more prevalent amongst European vehicles.

- **Diagnostic Trouble Code (DTC)**

These are obtained during a vehicle scan. DTCs are specific to module functions and outputs. A diagnostic trouble code does not indicate a specific component has failed, but that there is trouble within the component or its particular electrical circuit. Some trouble codes indicate a certain calibration has not been performed and some trouble codes indicate a malfunction. All trouble codes should be cleared from the vehicle and a road test completed before delivery back to a vehicle owner. Codes may not clear indicating additional diagnostic procedures and repairs are needed (see hard code). The absence of a malfunction indicator (dash warning light) is not a definite indication that no fault codes are present. It can only be confirmed by performing a scan with a compatible scan tool.

- **Diagnostic Trouble Code (DTC) Diagnosis**
  The process, research and time involved in determining the problems associated with DTC's identified in a scan and what repairs, calibration or parts would be needed for a complete and safe repair.

- **Drive Cycle**
  A vehicle cycle to reproduce all driving scenarios. Some of those scenarios may include: Starting the vehicle, drive through all gears, obtain complete warm up to engine operating temperature, steering fully in both directions, stop, idle, and shut off. Many trouble codes and self-checks require a drive cycle before a fault can be detected and trigger or pass a DTC self-check. Consult the individual OEM procedures for complete drive cycle requirements.

- **Dynamic Calibration**
  This is a calibration procedure that requires a vehicle to be put into a learn state and then operated under specified conditions for a vehicle computer system to “learn conditions”. When all of the conditions have been met the calibration is complete. Service information defines the requirements for each vehicle.

- **Fault**
  This is used to describe something not working on the vehicle as designed. System and circuit faults that are monitored by the module will result in a diagnostic trouble code being set off as long as the fault being analyzed by the module programming is outside of the expected results. Faults that set trouble codes may or may not produce a symptom (something not working or working improperly or a dash warning light). Dash warning lights and the DTCs stored are symptoms indicating the actual fault.

- **Flash**
  This is another term to describe programming. Flash and programming are used interchangeably. Sometimes used together “Flash Programming”.

- **Freeze Frame Data (Failure Records)**
  Freeze frame data is a requirement for emissions related codes in OBD2 standard. Technicians use this data to help determine the conditions of fault, and to help recreate the fault conditions if the fault is intermittent and not current. The amount and type of data stored is dependent on the programming manufactures supply for any given module. Some give very specific data such as time, mileage, speed, and inputs that were present at the time of fault, this varies significantly from vehicle to vehicle and module to module.

- **Function Check**

This is a task to see if something works, checking operation of a component or system. Verifying a function works as expected. Part of a Quality control check.

- **Hand Held Scan tool**
  A scan tool that is self-contained as a single unit. Includes built in software, vehicle communication interface, vehicle connection cables and user controls. Hand held scan tools capabilities can vary widely.

- **Hard fault**
  This is a fault that is continuously monitored and is present at the current time of scan (code will not clear) When a hard fault is encountered the fault must be located and repaired before the code can be cleared or any additional module set up, programming, calibrations etc. can be completed.

- **History Code**
  A fault code that is not current. This is a code that was set at some point and has passed the modules subsequent self-check. (condition is not current) history codes can be set due to marginal operation within certain parameters, intermittent conditions/faults or a fault that has been corrected but the code history has not been cleared. History codes may or may not include freeze frame or failure records associated with the code.

- **Intermittent fault**
  This type of fault can be continuous monitored or conditionally monitored. The fault may be conditionally present or intermittently creating symptoms. Intermittent faults, if monitored, will store a failure code but might not turn on a malfunction indicator (dash warning light). These can be the most difficult faults to locate and correct.

- **J2534-1**
  J2534 is an interface standard designed by SAE (Society of Automotive Engineers) and mandated by the US EPA (Environmental Protection Agency) for vehicle ECU reprogramming. Its purpose is to create an API (Application Programming Interface) which would be adopted by all vehicle manufacturers, allowing the Independent Aftermarket (IAM) the ability to reprogram ECU's without the need for a special dealer-only tool.

- **J2534-2**
  This is an extension of j2534-1, using the same vehicle communication standards as module programming and adds full functionality of OEM scan tool application software. Using this standard with OEM software is the same standard used by OEM franchised dealers. (cant make sense of the last part of sentence) See NASTF.org for more information on OEMs who are using this functionality for OEM scan tool software.

- **Key Cycle**
  This is used to describe the vehicle going from "on" to "off" to "on".

- **Key On Engine Off (KOEO)**

This would seem to be a pretty simple process but has become a bit more complex since keyless start and hybrid technology has been introduced to automobiles. This state powers the vehicle without the engine running and therefore runs the battery down quickly. When this mode is required for prolonged periods battery support is required.

- An older style “key type” ignition switch is straight forward. Turn the key to the run position without starting the vehicle.
- Keyless start systems, also known as push-button start, is a little different and it is easy to think you have the vehicle in the on position but it is actually in “accessory” mode. Over 90% of these achieve KOEO state by pushing the start button 2 times 1-2 seconds apart without pressing the brake pedal. Some push button start vehicles require pressing and holding the start button for 10-15 seconds without pressing the brake pedal. *(the key fob must be in the interior of the car) you can tell you reached this state by the behavior of the instrument cluster. Gauges and warning lights should sweep, warning indicators will bulb check. To turn the vehicle off press the start button one time. To start the vehicle, push the start button one time while depressing the brake pedal.
- Hybrids can vary, but for KOEO the vehicle must be in ready mode. This state can be accomplished the same way as push button start if the vehicle is equipped.

- **Key On Engine Running (KOER)**
  This is exactly what it states, the car is on with engine running or “ready” mode for hybrids.

- **Latched Code**
  This is a code that sets in an airbag module that cannot be cleared and requires replacement of the module. This type of code is dependent on the manufacturer of the vehicle and the severity of the deployment. A scan of the airbag system is necessary to determine if a code is latched within a module, whether or not a deployment occurred. To determine if a code is latched the vehicle must be scanned before airbag repairs are made, all codes stored must be recorded and deployed components identified. After this the” crash detected” or “deployment commanded” codes can be cleared by the scan tool. If they return, module replacement is necessary. If they do not return airbag system repairs can be made without replacement of the module.

- **Live Data**
  This is obtained during a scan using a compatible scan tool for the vehicle and system being scanned. Live data is actual sensor input values, circuit resistance values, and module output states that are displayed on the scan tool screen for the technician to interpret. Data that does not look normal or is out of range for the vehicle state warrants further investigation into the condition depending on the fault or malfunction that needs to be corrected.

- **Malfunction Indicator lamps (MIL) AKA warning lamps, warning messages**
  A MIL is any of the warning lamps included on a vehicles instrumentation. These include but are not limited to; Check Engine, Service Engine, Service Vehicle, Airbag, SIR, ABS, Stability, Tire Pressure, Oil, Coolant, etc. Not all lamps are directly controlled from the vehicle computer system but most are. Some malfunctions are displayed via a texted message center rather than by a specific MIL.

- **OBD2 Scan tool**
  A scan tool that is equipped with only the basic emission controls capabilities. Anything beyond OBD2 spec is considered Enhanced (Proprietary) non-regulated data or advanced scan tool functions. **Body controls, Airbags, Anti-lock brakes, Theft Deterrent, seat belt data, etc. are not included** in this specification and are not OBD2.

- **OEM Scan Tool**
  A scan tool or scan tool application (Program) that is designed and produced by an OEM for their vehicles.

- **Output test**
  This is a bi-direction control from a scan tool to activate a component for diagnostic purposes or operational verifications, examples are commanding components such as headlamps, cooling fans, A/C compressors, wipers, door locks etc. to activate. This is a scan tools ability to take control of a vehicles functions while connected.

- **Pending Code**
  This is a code that has failed or marginally passed the vehicles built in test routines. The module will store the code in pending status until operational conditions are correct for the module to self-check the particular system the code is for. If this fails, the code will set as a current code. If it passes 2 or more consecutive self-tests the pending code will self-clear.

- **Permanent Code**
  Permanent codes were introduced in 2009. They are only associated to emission codes (OBD2 codes). They were introduced to have a 2-step process to clear. When these types of codes are cleared with a scan tool the code still reports buts changes to "permanent status" meaning a vehicle road test (drive cycle) to meet the operational requirements for the particular circuit/system to self-check and pass must take place before the code will be completely cleared. A permanent code does not mean there is current trouble, only that the system has not passed self-test. If the code fails self-test the code will change state from permanent to current.

- **Pin-Point Diagnostics (On-Vehicle Testing)**
  Procedures needed after trouble areas from scan data are identified, includes close visual inspections, circuit testing wiring repairs, and electrical tests with voltmeters or test lamps. Additional diagnostic and electrical testing skills following service information test procedures must be followed.

- **Pre Scan (Pre-repair Scan) (Quick Scan) (Inspection Scan)**
  Performed before repairs, part of repair planning or blue printing, Purpose is to identify areas of concern within the vehicles computer networks, components and safety systems. Includes defining and assessing relationship of faults to vehicle damage, review of service information and diagnostic or repair procedures related to faults and data recovered from scan data. All diagnostic data must be documented at this time.

- **Post Scan (Post Repair Scan) (Completion Scan) (Calibration Scan)**
  Performed when vehicle is completely re-assembled before final QC. Insures all required calibrations and/or necessary programming procedures are completed, all systems checked with all system codes cleared and/or system re-initialization. Verification of warning lamps and basic system functions are verified with all calibration procedures and scan results documented. (before and after code clearing) Does not include calibrations or programing only that they have been completed and all modules are ready for use.

- **Programing**
  This is a procedure that must be performed to most replacement modules in an automotive computer network and is the first part of setting up a replacement module for most manufactures. Many new replacement modules come with generic base software that is not capable of operating in any specific vehicle until the program file (instructions for the module to operate in the vehicle it is going into) is completed.

This requires a proper identification of the vehicle, downloading of the proper programming file from the manufacture, and then transfer of the file into the module. This procedure is very exacting and has specific steps to be completed. If any mistakes are made in the sequence, or connection interruptions occur, the module being programmed may be rendered useless.

- **Quality Control (QC)**
  The final step of a vehicle inspection with function tests, road test and inspection before delivery back to customer.

- **Scan (Scanning)**
  This procedure, using a scan tool, to communicate directly with any system on the automotive computer network the scan tool is capable of. A scan cannot always tell you specifically what is wrong with a vehicle but it does make the needed data available to a diagnostic technician who determines what the failure possibilities are based on codes, symptoms and live data.

- **Scan tool**
  Scan tools come in many shapes, sizes, configurations and capabilities. These can be simple code readers to enhanced aftermarket tools that include programming, coding, and calibration capabilities to Manufacturer OE tools. OEM scan tools are limited to the manufacturer of origin, but have the complete suite of capabilities. Scan tools also come in a variety of hardware and software configurations including PC or laptop based tools connected with a vehicle interface to hand held tools with built in interfaces and software.

- **Service Information**
  Sources for vehicle repair information, schematics, wiring diagrams, calibration procedures, repair instruction and diagnostic test procedures. There are multiple sources for information ranging from OEM dealership level specific subscriptions to all-inclusive providers such as I-Car, Alldata, Mitchell, Identifix, and more. Service information found from non OEM providers are sourced from OEMs. Information can be 1-2 years behind as information is formatted into the provider's systems. Most do have assistance services to provide information that has not yet been added to online sources. Subscriptions for service information must be purchased from providers whether OEM or 3rd party providers.

- **Static calibration**
  This is a calibration that is done with a scan tool in a known condition to calibrate a vehicle. Most commonly refers to target placement at a specific distance for ADAS system calibrations.

- **Vehicle Communication Interface (VCI) (J-Box) (API)**
  This is an interface between a laptop, tablet, or PC to allow application based scan tool software to communicate with a vehicle. These devices convert vehicle communication protocols to be compatible with a PC for diagnostics.

- **Zero-Point Calibration**
  Another type of static calibration, most commonly used for occupant detection and steering angle calibrations.

Also applies to Brake pedal position sensors and Idle air control “Idle learn” procedures. This calibration is done to establish a zero point for the computer (0 lbs. for an occupant detector, 0 degrees for a steering angle sensor, etc.).