# What info to have ready, when you call Diagnostic Hotline

- 800-260-9377 (8:00am-5:00pm CST)
- Have 6 digit member account #
- Have shop phone # (including area code)
- Year, Make, Model
- Engine Size
- Transmission type: Automatic, Straight-Shift
- 4x4, 2x4
- Customer Complaint
- ALL Diag info gathered

## Basic checks

- Verify Complaint
- Perform “Auto-Scan” / Quick-Scan interrogate all controllers
- Check & Record all DTC & Freeze-frame data
- Clear codes, does code return immediately or is fault intermittent (MB)
- Check Mode 6
- Check Basics - Compression, Vacuum, Coil Output, Fuel Psi / Trims,
- Check Charging System: target DC voltage, & Max AC voltage output
- Check Battery: State of Health, State of Charge
- Check Cranking Voltage (10.8v min)
- When checking circuits “Voltage drop” all circuits

## Optional Advanced Drivability checks

- Ck. Codes: OE side & OBD-2 Global / Generic)
- Ck. FUEL TRIMS % low RPM & high RPM (in gear)
- Ck. MAF readings G/second @ idle
- Ck. MAP readings
- Ck. Vacuum leaks
- Ck. Compression in spec ? (6 puffs minimum, throttle open warm mtr)
- Ck. Running Compression test (idle snap WOT, & 2000 rpm’s) live cylinder volumetric efficiency
- Ck. MAX COIL OUTPUT, ( ¾ inch minimum blue color)
- Ck. Spark Plug brand & model # correct ? (Honda, Saab, Mercedes)
- Ck. ECTS (coolant temp sensor) Accurate Cold, in spec?
- Ck. TPS in spec ?
- Ck. FUEL PSI in spec?
- Ck. FUEL INJ. Spray Pattern
- Ck. Good Fuel ? - Vapor Pressure Issues, Possibly low quality old ?
- Ck. VAC low RPM & high RPM
- Ck. Cam Timing Belt, Check Timing Chain, (loose or jumped) ?
- Ck. EGR Closed Fully ?
- Ck. Front O2 Output operation
- Ck. CARBON Build up on backside of Intake Valves
- Ck. Charging system DC & AC output (100mv max)

# GM PATTERN FAILURES

## 1- 1999 & up Silverado / Sierra/ Sub / Yukon

P0446 replace vent solenoid / filter gets plugged with dirt/moisture

## 2- 2002 & up Trailblazer / Envoy, C0327 monitor encoder position /voltage

@ 55 mph, Replace encoder sensor and reprogram TCCM

## 3- Automatic Transmission Shift, Engine Driveability Concerns or Service Engine Soon (SES) Light On as a Result of the Use of an Excessively/Over-Oiled Aftermarket, Reusable Air Filter-

The use of an excessively/over-oiled aftermarket, reusable air filter may result in:

- Service Engine Soon (SES) light on
- Transmission shift concerns, slipping and damaged clutch(es) or band(s)
- Engine driveability concerns, poor acceleration from a stop, limited engine RPM range

The oil that is used on these air filter elements may be transferred onto the Mass Air Flow (MAF) sensor causing contamination of the sensor. As a result, the Grams per Second (GPS) signal from the MAF may be low and any or all of the concerns listed above may occur.

When servicing a vehicle with any of these concerns, be sure to check for the presence of an aftermarket reusable, excessively/over- oiled air filter. The MAF, GPS reading should be compared to a like vehicle with an OEM air box and filter under the same driving conditions to verify the concern.

## 4- 6.6L Diesel Engine DTC P0101

If diagnostics were inconclusive its possible **DTC P0101** is setting due to a Non-GM air filter. **Non-GM air filters have shown a slightly higher than normal MAF reading**

## 5- 2004-05 Malibu & Pontiac G6

**Noise in Steering Column, Lack of Power Steering Assist, DTCs C0460 and C0545, Steering Wheel Moves Slightly By Itself**

These conditions may be caused by excessive clearance between the assist gears or by a failure of the torque sensor in the steering column.

Technicians are to install a new steering column kit, P/N 15926870

## 6- 1996-2009 All General Motors Passenger Cars & Light Duty Trucks

Customer concern of **poor acceleration, detonation or "ping"** at idle in drive or reverse, and/or possible DTC P0101, P0106 and/or P0121 set in the PCM. The vehicle will perform properly after attaining a speed of about 30 - 40 mph.

The following checks should be performed in the event that normal engine driveability checks have not resolved the detonation or "ping" at idle in drive or reverse, lack of power from a stop, stall, and surge on acceleration and or hesitation complaint.

The IAC counts throttle angle and/or MAP voltage and KPA should be compared to a like vehicle in park and in gear after reaching operating temperature. If the counts and map are high or throttle angle is open excessively in comparison this may be a result of high engine load and a torque converter and or stator support shaft related concern.

If the above information does not lead to resolution, follow torque converter diagnostics listed below:

The transmission **oil cooler outlet line** (line to the cooler) should be checked for **excessive heat**. The Tech II scan tool may be helpful on vehicles equipped with the transmission fluid temperature sensor in the cooler line (mainly front wheel drive). On vehicles that do not have the temperature sensor in the cooler line a temperature probe should be used to check the temperature. The temperature readings should be compared to a like vehicle with the same powertrain option content.

A stall test (brake torque) may point to a damaged **torque converter**; the stall rpm speed will be lower than a like vehicle. However, poor engine performance will also produce a lower stall speed rpm.

If the **torque converter stator or stator support** is suspect, the transmission should be removed and **THE STATOR SUPPORT SHOULD BE INSPECTED FOR SPLINE DAMAGE**. If the stator support splines are damaged the transmission should be repaired and new torque converter installed. If damage is not present on the stator support the concern is either internal to the torque converter stator or an engine performance concern.

## 7- 1998 PONTIAC GRAND PRIX

**TRANSAXLE ERRATIC & / OR NO SHIFTS, STUCK IN 3RD GEAR**
**Codes P0711, P0712, P0713, P0716, P0717, P0741, P0748, P0753, P0758, PI810, PI860**

Wires to the Torque Converter Clutch (TCC) **Switch may CHAFE against a reinforcement rib on the transaxle's side cover and the bottom of the air cleaner assembly. Damage to the Harness may result in stored Codes of** P0711, P0712, P0713, P0716, P0717, P0741, P0748, P0753, P0758, PI810, PI860, And / or open fuse in the TCC circuit this condition may cause one or more Shifting Concerns, or Stuck in third gear.

## 8- 1999-2007 Cadillac, Chevrolet, GMC Full-Size Pickup and/or Utility Trucks

**with 4.8L, 5.3L, 5.7L, 6.0L or 6.2L VORTEC GEN III, GEN IV, V-8 Engine**

### Engine Misfire MIL/SES Light Illuminated or Flashing DTC P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0420 or P0430

If you encounter vehicles that exhibit the above conditions, refer to SI for the appropriate DTC(s) set. If no trouble is found, the cause may be due to an **ECM ground terminal that has corroded** with rust over time. Inspect the main engine wiring harness ground terminal (G103) for this condition.

**The wire terminal (G103) attaches either to the front or to the rear of the right side cylinder head**, depending on the model year of the Full Size Pickup and/or Utility Trucks. If the **ECM ground terminal has been found to be corroded**, then follow the service procedure outlined in this bulletin to correct the corrosion issue.

**9- GM Trucks** with 4l60E transmissions may experience a hard shift with high line pressure.
No codes. If the ECM sees high current draw from shift solenoids it will default high line pressure.
Amps test transmission solenoids.

**10-** 1996-1999 **Chevy trucks** CMFI 350 & 305 misfire @ idle and part throttle.
Not noticeable @ WOT, cylinder specific on misfire counter.
Possible worn distributor drive gear

**11-** 1995-1997 **Cavalier**. No start / DTC intermittent No start /or any combination.
Inspect the ECM and connectors for water intrusion.

**12-** 1994 Geo **Tracker** ERG code. Check wiring near intake manifold ground for short to ground.

**13-** 1990-1993 **S-10** 4wd front axle stuck engaged. Check for failed transfer case vacuum switch.

**14-** 1989 **BUICK OLDS** PONT- No Start. Reground module or clean surfaces on mounting brackets.

**15-** 1990 **W- BODY** NO REFRENCE VOLTAGE UNPLUG COOLANT LEVEL SENSOR

**16- Late model GM-** I.P cluster, gauges inter. Innop, also Transmission shifting issues.
Failing ignition switch monitor power@ top of fuses for intermittent loss of power.

**17-** Blown fuel pump fuse- Not always a faulty fuel pump, Check for shorted oil pressure sw/ sensor, common failure.

**18- Mid 90's trucks** w/ 5.7L eng. Sets po325 knock sensor code. Many times is failed knock sensor,
But also check for intermittent Conductivity of knock sensor circuit wiring problem.
Run replacement wire, if necessary. Usually opens as passes thru firewall.

## Ford pattern failures

1. 2004-07 F150 5.4L spark plugs break off. New tool kit 303-1398. The tool kit makes removing the broken spark plugs a 10 minute job. TSB 08-7-6

2. 97-03 f150 4.6, 5.4, 6.8 spark plugs blow out. Ford approved HELI coil kit: Rotunda # 302-00001 TSB # 07-21-2

3. 99-03 3.8 Windstar lean codes p0171, p0174, plenum o-rings and bolt kits TSB 03-16-1

4. 01-04 f150/e150 4.2 engine with lean codes p1131, p1151 plenum o-rings and bolt kits TSB 5-22-6

5. 2000-06 Crown Vic, Town Car, Grand Marquis with interior, or exterior light concerns, after verifying switches and harnesses are good the lighting control module (LCM) has been known to short out, and cause everything from headlights not working, to dome lights, staying on, to battery drains.

6. 97-03 f150-4x4 inop. Front diff doesn't lock in when there is vacuum applied to actuator motor: remove front differential and remove passenger side tube, replace shift lever and gear assy kit

7. 98-03 Contour, ZX2, Mystique, Cougar with 2.0 DOHC VCT codes p1380, p1381, p1383, or p0340, check TSB's 00-3-7 and 03-15-14

8. All Ford models with egr from 2000-03 p0401, p0402, p1400, p1401 If egr opens and closes. Replace DPFE sensor per TSB 04-11-1

9. If working on a Ford and it has a miss, but it is not setting a code for the miss. Go into the OBD2 (generic) side of the scan tool and access Mode 6 data. Find codes 51 and 53 and open them, it will display 1-8 (on 8cyl), and look for higher misfire counts the cyl with the higher counts, is the cylinder with the misfire. Most aftermarket scan tools can access this info on 2000 on up vehicles.

10- 1997-03 F150/f350 no start. If the instrument cluster doesn't display the mileage, or just has dashes in it. Send the IC in for repairs. The IC is the module for the PATS system.

## We didn't even touch on diesels

11- **All Fords**. Wipers park in up position after motor replacement: Linkage assembled 180* off

12- 1998 **Windstar** intermittent runs poor: hose to PCV valve soft and sucked shut

13- 1999-00 **Windstar**, Rattling noise from intake: Internal runners loose, replace upper half of upper intake

14- 1996 **Taurus/Sable** loss of radio, P/S, and power windows when put into drive Shorted TR sensor

15- 1998-99 **Escorts** P1380 and/or P1383: debris stuck in VCT solenoid.

16- 1992-1996 **Crown Vic, Grand Marquis, Town car** codes 332, P1401 plugged EGR passages

17- **F & E** series with 7.3l Power Stroke, long crank, no oil in reservoir for high pressure pump: replace check valve with stand pipe

18- 1998-99 **Escort**, a/c innop after relay module replaced. Wrong module installed. Standard escort and ZX2 use different modules.

19- 1996 and newer **Taurus/Sable** P/S fluid shoots out after shutting off engine. Need to bleed P/S with a vacuum on the reservoir

20- **Taurus/Sable** with loss of radio, wipers, power steering, and power window when shifted into reverse, caused by a short in the transmission range selector switch. New part number is available.

21- **Pre-1997 Ford trucks** with Diesel engine and low brake pedal or pedal drops while stopped with foot resting on brake. A new "zero loss" vacuum brake booster is available. Must order by part number, not by application.

**22- Windstar** 1999-2000 3.8l Codes P0171 and P0174, Check for small vacuum leaks at IMRC bushings while watching SFT for a change.

## CHRYSLER

ATM output mode testing

**0-** Chrysler / Dodge / Jeep **Recall**- Brake Failure

**1-** Jeep Grand Cherokee 2010 **Recall**- SRS Pass Airbag improper deployment

**2-** Code 440 441 Chrysler's (Natural Vacuum Leak Detection)
NVLD switch sticks open or closed replace NVLD Module.

**3-** Code 404 405 406 electric EGR, Bad EGR position sensor or sticking EGR
Replace EGR check for TSB'S some models require PCM flash

**4-** All 3.7L & 4.7L engines misfire; rockers fall out, check valve springs, valve carbon, plugged oil holes, valve guides and valve seats

**5-** When replacing any sensors or solenoids' on NGC computers erase all memories and codes

**6-** Chrysler 2001-05 mini van - power steering noise - check for plugged screen in reservoir if plugged will burn out pump poss. bad rack causing screen to plug

**7-** 1993 - 1997 LH bodies A/C innop check for shorted failed A/C transducer and fin sensor

**8-** Jeep 4.0L Misfire at idle- Weak valve springs and valve carbon

**9-** Chrysler- 3.9L, 5.2L & 5.9L engines miss, ping and or oil usage lower intake gasket internal leak

**10**- 1996-98- 3.9L, 4.0L, 5.2L, 5.9L engines No charge after pcm disconnected with ignition on. Ignition switch needs to be off when pcm disconnected or the pcm resets the charging target Voltage to 0 volts, the only fix is to replace the pcm.

**11-** Jeep 1987-1990: 4.0L- No-Start, low output from crank sensor, need 500mv ac to start & run.

**12-** Chrysler 1996-97 - minivans wipers self activate or won't park check the BCM junction box connections.

**13-** Chrysler - 2.5L V6 misfires at idle, ck egr for sticking open and valve carbon

**14-** Chrysler ABS and BRAKE light on after PCM replacement need to program VIN # and mileage into pcm.

**15-** Chrysler Transmissions- 41TE & 42LE transmission- No speedometer, may be in limp-in,

Check connectors at input and output speed sensors

**16-** 2000 Chrysler LHS 3.5L alarm malfunctions - HVAC- performance problems- ODIS- Overhead display–slow to update- PCM needs reflash.

## ASIAN PATTERN FAILURES

**Toyota** **Recall** Floor mats, Gas Pedal Sticking
**Toyota** **Recall** Hybrid Brake failures
**Honda** / **Acura** **Recall** SRS, A-pillar loose - hurting Driver during deployment
**Honda** **Recalls** Power Window Switch Fire Hazard
**Hyundai** **Recall** Azera, SRS Faulty Air Bag
**Toyota** 2000-2003 **Recall** Tundra, Rear Cross member Failure, Due to Rust
**Mitsubishi** 2008-09 Lancer **Recall** Front SRS Sensor Failure Causing Deployment (salt intrusion)
**Nissan** **Recall** CKP, CMP, VVT-OCV failures, PCM box insulation removal
**Nissan** 2009 Models **Recall** with Bosch Master Cylinders Risk of Crash
**Mazda** 1997-2003 Truck **Recall** Cruise Switch Overheat, Fire Risk
**Subaru** Impreza WRX **Recall** 2002 & 2003 Fuel Leakage, Fire Hazard

**Hybrid (All**) Testing, circuit safety, Hybrid safe DVOM, Test gloves w/ air every time! Swop out gloves every 30 days, battery cells can be replaced individually

**Hybrid (All**) Dead HV battery-pack, use regenerative braking to recharge
**Hybrid** (**Toyota**) Valve train issues, low compression engine 125 psi, Atkinson cycle

The four-stroke Atkinson cycle, invented by James Atkinson in 1882, is different than the Otto cycle engine we're used to driving in very distinct ways. Compared to the Otto cycle, where the intake valve is closed near bottom-dead-center, the Atkinson cycle does not close the intake valve at BDC, but leaves it open as the piston rises on the compression stroke. What this means is that some of the air/fuel charge is pushed back out and into the intake manifold and is used in other cylinders. This reduces the volume of the air/fuel mixture that's compressed and combusted without severely restricting the throttle opening. Restricting throttle opening results in large pumping losses and greatly reduced efficiency. This method of reducing power output without incurring large pumping losses makes the Prius engine much more efficient than a conventional Otto cycle engine under most operating conditions. Effectively, the use of the Atkinson cycle allows the Prius engine to operate quite efficiently at relatively low power levels while still having sufficient power for climbing hills at freeway speeds

**Honda** V-Tek codes, ck oil level, viscosity, pressure, carbon build up, screen, etc

**Honda** No start, koeo check engine light on / off ck failed PGM FI relay

**Honda** Po171 Po172 failed Fuel Press reg. (updated), and re locate vac line

**Honda** civic, no start, or no hot re-start, faulty main relay, disassemble relay inspect p.c. board and you will likely find a cold soldering joint, replace relay or re-solder broken joint.(replacement is the best choice).

**Honda**-early 90's tcm issues- failed tcm module (units made by Mitsubishi) failed discrete components on p.c. board (repl. Unit)

**Honda** all distributor models, no spark, has noid, failed igniter (common)

**Honda**- all distributor models, no start w / eng hot soak- failed distr. Pick-ups, Replace distributor as an assembly.
**Honda**- automatic trans. Shift issues, - use only OE Fluid, aftermarket co-efficient of friction and special additives aren't present in high enough levels in some of the aftermarket fluids unless: specifically says ok for use in
**Honda** Po463 Fuel level sender voltage code, updated sender & reflash updated Cal ID

**Isuzu**- misfires / cat damage, due to Aftermarket alarm / remote start

**Mitsubishi** high timing belt failure, (2.0L) be sure to replace the hydraulic tensioner with the balance shaft and the main timing belt, if not the belt is likely to fail early. The tensioners have been through many revisions, Ring damage / Ring shock oil consumption afterwards.

**Mitsubishi** many failures, Modules, IAC, distributors, gm Chrysler modules,

**Nissan 3.0L** P1320 Requires New Updated Ign coils (all 6)
**Nissan (All**) Po325 Po328 failed Knock Sensors, replace BOTH, torque properly
**Nissan (All**) codes Po446 etc, failed CCV, Failed canister contamination
**Nissan Altima** 2.4L engine with any stored misfire codes, or any drivability concerns. Check the distributor cap for oil in it. If so, replace "Complete distributor" check PCV and Blow-by

**Mazda** Po171 failed Maf common issue

**Mazda** Wankel Rotary engine floods, permanent rotor seal failure, always warm-up fully

**Nissan** mid 90's inter stall or no start 1.6 & 1.8L failed distributor (common)

**Nissan** Idle speed codes IAVL, or Min Vol Air Idle relearn, Never touch Throttle Plate !

**Nissan** Po325 Po328? failed knock sensor & pigtail

**Nissan** 3.0L misfire's failed fuel .injector resistance (most had a spec. 10-14 ohms @ 68 degrees. Most failed well above 14 ohms or went way high w/ they got hot causing a misfire.

**Nissan** 3.0L max sets tranny or pcm codes (or even stall & no starts) failed engine wiring loom @ right front strut tower area. Disassemble loom and inspect all associated wires TSB

**Subaru** Po505 (1 coil or noid innop) check IAC issue, pcm cut coil to lower curb idle

**Toyota 2005 Prius**, Oil change, Engine runs with the Oil Drain Plug in hand,
To disable: there's a button / switch that allows you to disable the smart key system.
Simply press the button in, and the Smart Key system will be disabled

**Toyota** P1300 Spark, Noid, Igniter, IGT, IGF, NE, G1, G2 sensors Diagnosis

**Toyota** Evap codes Po446 etc, check failed CCV solenoid, Failed Evap canister

**Toyota** P1780 “prindle” code check aftermarket alarm or remote start

**Toyota** P1349 VVT caution replacing Actuator front of cam, finesse not force

**Toyota** Camry internal distributor coil, HV leaking ck carbon tracking on coil

**Toyota** Po401 egr, check sticking egr, vac modulator, vsv valves

**Toyota** (most) Front suspension / alignment issues – “strut Indexing” (call us on procedures)

**Toyota** successful SRS code clearing manually- complex “dance” using DLC

## EURO PATTERN FAILURES

**Mercedes “SMART PEDAL TECHNOLOGY”**

**Q.** CAN WHAT’S HAPPENING ON TOYOTAS HAPPEN TO MERCEDES?
**A.** These are two different systems. For example, Mercedes vehicles have "Smart pedal technology" or Brake-Override system, which can slow a vehicle when the driver applies the brake pedal if an accelerator pedal ever becomes stuck.

**Q.** HOW DOES THE MERCEDES “**SMART PEDAL TECHNOLOGY**” WORK?
**A.** When the Mercedes brake pedal is pressed and the accelerator pedal remains engaged, the electronic signal propelling the car is interrupted, and the vehicle is automatically slowed to idle.

**Q.** HOW LONG HAS MERCEDES HAD THE “**SMART PEDAL TECHNOLGY**”?
**A.** Mercedes started introducing the “smart pedal technology” as early as 2002

**Land Rover** 2010 Range Rover **Recall** SRS Front Sensor / Control Module
**Mercedes** 2009 G-Class **Recall** Fuel Line Quick Connectors under the Vehicle leaks
**Ferrari** **Recall** 1995-1999, 355 and 355 F1, under hood Fuel Leakage, Fire Hazard
**Jaguar** 2010 Models **Recall**, Fuel Transfer Pipe Kinked Stalling Potential Crash
**Volkswagen** **Recall** 2009 Q5 SRS, A-pillar loose - hurting Driver during deployment
**VW** & **Audi** **Recall** on many, ignition coils
**Volvo** **Recall** 2001-2005 Models, Defective Fuel Pump: Fire Hazard
**Volvo** **Recall** 2010 XC60 Vehicles: under hood Fuel Leakage, Fire Hazard

**BMW E65** series “space shuttle 120-140 Controllers / Modules on board

**BMW** Valvetronic (no throttle plate), Vanos VVT (single & double),

**BMW** cannot reset service or maintence light - Failed SI board in IP cluster

**BMW** Failed IPC due to extended time of door chime operation

**BMW** synthetic oil Only, (quiet recall / warranty coverage, failed 3 series engines

**BMW** late model will not idle smoothly, they will set lean codes, Repair un-metered air leak @ intake manifold, a plate (pcv) replacement will be necessary

**Mercedes** 2004-08 evap leak, “Low Gas” light will FLASH

**Mercedes** Instrument cluster / electrical issues- networking “roll call” issues

**Mercedes** Po171, Po174, fuel psi ok & no vacuum leaks found, check failed Bosch MAF. Clear Adaptations, before releasing vehicle

**Mercedes** Fiber Optic system, sub-harness $18,000 per section, don’t use sharp tools

**Mercedes** SBC caution software deactivation required (lifetime warranty) 16 bar / 232 psi
**Mercedes** ABR plays friendlier, no deactivation required

**Mercedes** hard / no start- faulty fuel pumps. (Common)

**Mercedes** SAM failure (smart fuse box) will need coding upon replacement

**Mercedes** mid-90’s throttle system stuck in failsafe bad-- throttle motor assembly requires replacement (common)

**Mercedes** Smart Key pops out while driving, “call us for more info”

**Saab** (Body System Failure) “MOST”- fiber optic system, Audio Amp Failure

**Saab** DI cassette failure, check installed spark plug height

**Saab** Starting / drivability issues, check inter failed CKP (2 wire)

**Volvo** all new models- most parts on car if replaced (even a window motor) will require a program downloaded from Scandinavia via- satellite dish @ local dealer to. Activate the replaced component- or access to a Vadis system (OE program yearly subscription)

**Volvo** Po171 failed Bosch Maf meter (common).

**VW** No Scanner Communication usually ABS module failure, unplug & re-scan

**VW** No-Start, Faulty “Comfort Module” under drivers’ seat, corrosion issues, Coding required

**VW** if you disconnect the battery, and the pcm and throttle module looses Memory power (30 power), the car will not re-start, or may restart but will not accelerate
FIX “Basic Settings” & “Throttle Adaption” must be done (Sugg “Hot Swop”)

**VW** P0171 lean code and the fix- will be a new Maf meter limited (quiet recall) on some

**VW** ECTS code, Updated ECTS 4 wire Green to Black

# Diagnostics / Equipment / Training / Tips

- Verify Complaint
- Perform “Auto-Scan” / Quick-Scan interrogate all controllers
- Check & Record all DTC & Freeze-frame data
- Clear codes, does code return immediately or is fault intermittent (MB)
- Check Mode 6
- Check Basics - Compression, Vacuum, Coil Output, Fuel Psi / Trims,
- Check Charging System: target DC voltage, & Max AC voltage output
- Check Battery: State of Health, State of Charge
- Check Cranking Voltage (10.8v min)
- When checking circuits “Voltage drop” all circuits
- When testing circuits **Don’t use**: **Ohm meter** (except resistors, windings) **Power Probe** or **Test light** or **Headlights**
  Instead **Voltage Drop** testing more accurate
- Use Micro-controlled Battery Power Supply 50-95 amp rating
- Scope signals “to fast” for a DVOM
- No Start: Check Engine light on KOEO
- No Start: Cranking Vacuum
- No Start: Immobilizer / Security light on or flashing while cranking?
- No Start: Pids- Immobilizer PCM-“Set / unset” PCM “locked / unlocked”
- Battery parasitic draw .050 amp max, measured series unbroken
- U-codes check Powers & Grounds, Battery / Alternator

## General knowledge / Conversions

**KHz** (means thousands)
**MHz** (means millions)
**GHz** (means billion)

**KiloHertz** (thousands of Hertz)
**MegaHertz** (millions of Hertz)
**GigaHertz** (billion of Hertz)

**Second** **(s)**
**Millisecond**- 1 thousandths of a second **ms**
**Microsecond**- 1 millionth of a second **µs**
**Nanosecond**- 1 billionth of a second **ns**
**Picoseconds**- 1 trillionth of a second **ps**

**NETWORK SYSTEMS**

**MULTIPLEXING Many packets of information going through twisted pair at the same time**

**CAN serial data bus (P can (**pwr train**), B can (**body can**), C can)** **1 Mb/s (**Mega millions)

**CAN** is “self Healing”

**BEAN Bus, P-Can, I-Can, C-Can, B-Can, PT-Can**

**BYTEFLIGHT (Star bus) Fiber Optic** **10 Mb/s (**Mega millions)

**FLEX RAY** BMW High Speed Bus **www.FlexRay.com** **10 Mb/s (**Mega millions)

**D2B** (Domestic Digital Bus) **Fiber Optic** **20 Mbs (**Mega millions)

**MOST** (Media Orientated Systems Transport) Ring bus**, Fiber Optic** **150 Mb/s (**Mega millions)

**LIN bus** **??? Mb/s (**Mega millions)

**Gateway** Translator- between Data Bus networks

## **Super Speed USB** moves data at 5 Gbits /s (billion)

| | Song / Pic | 256 Flash | USB Flash | SD-Movie | USB Flash | HD-Movie |
|---|---|---|---|---|---|---|
| | 4 MB | 256 MB | 1 GB | 6 GB | 16 GB | 25 GB |
| USB 1.0 | 5.3 sec | **5.7 min** | **22 min** | **2.2 hr** | **5.9 hr** | **9.3 hr** |
| USB 2.0 | **0.1 sec** | 8.5 sec | 33 sec | **3.3 min** | 8.9 min | 13.9 min |
| USB 3.0 | **0.01 sec** | **0.8 sec** | **3.3 sec** | 20 sec | 53.3 sec | 70 sec |

# SCOPE INFO

**FYI -** Learning proper operation of Lab-scopes
3-12 months to get to 85%
Additional 1 year to get to 95%
3 years to get to 100%

**Analog bandwidth**
2 MHz, 5 MHz, 10 MHz, 100 MHz, 300 MHz, 500 MHz & 1**GHz** (billion) bandwidth

**Maximum sampling rate**
The maximum number of samples the oscilloscope is capable of acquiring per second.
Maximum sample rates are usually given in MS/s (megasamples per second) or
GS/s (Giga (billion) samples per second)

The higher the sampling rate, the more accurate the representation of the fine details in a fast signal.

**CAN** Speed **1** MHz (million) (measuring 10x factor)
**Scope** (sample rate) minimum 10 MHz, MS/s minimum (to watch CAN signals)

**Agilent $20,000.00** **4 GHz SPS (Gig=Billion samples / sec) not MHz**

**PICO 4423** **80** MHz, MS/s, MSPS samples/sec
**Fluke 97/98** **25** MHz, MS/s**,** MSPS samples/sec
**UEI ADL 7100, Ls2000** **5** MHz, MS/s**,** MSPS samples/sec
**UEI ADL 7103** **20- 25** MHz, MS/s, MSPS samples/sec
**Snap-On Modis** **6** MHz, MS/s**,** MSPS samples/sec
**Snap-On Verus** **6** MHz, MS/s**,** MSPS samples/sec
**Snap-On Vantage Pro** **8** MHz, MS/s, MSPS samples/sec
**Bosch / Vetronix MTS 5100** **1** MHz, MS/s**,** MSPS samples/sec
**Bosch / Vetronix MTS 5200** **N/A** (4 dedicated A/D converters)
**Bosch** (2 ch) **KTS 570** **10** MHz, MS/s, MSPS samples/sec (**both ch. driven**)
**Bosch** (2 ch) **KTS 670** **10** MHz, MS/s, MSPS samples/sec (**one ch. driven**)
**OTC SPX Solarity 3852** **4** MHz, MS/s, MSPS samples/sec (**all channels driven**)
**OTC SPX Pegisys Scope** **N/A**
**OTC SPX Genisys Scope** **N/A**
**Tektronix 222A (2-ch) DSO** **1** MHz, MS/s**,** MSPS samples/sec (Max. Single Shot bandwidth)
**Tektronix 465 (4-ch)** analogue **N/A**

www.autonerdz.com/java/SampleRateCalculator.html

**Input-**

- Max sample rate (MHz)
- Milliseconds (screen time)
- Buffer size (samples)

**Results (output)**

- Requested sample rate (defined later)
- Actual sample rate (Hz / KHz)
- Time between samples (Seconds, Milli-Seconds (1,000), Micro-Seconds (1,000,000)
- Samples on screen