

## GM Electronic Throttle Troubleshooting With the X-Link Installed

### X-Link Version Identification:

1.0 no pink wires, all wires pass through the box, 2 rubber grommets

2.1 has a looped pink wire inside each wire loom, all wires pass through the box, 2 bushings/grommets

3.0 similar to 2.1 without the pink wires, 2 nylon bushings

3.5 same as 3.0 but has a "4" or "IV" inscribed on the box next to the mounting stud

4.0 only 4 wires connected to the box through a single bushing/grommet

Mini no metal box, silver blade version has an "S" engraved on the 6 way connector, others are gold blade(black/red sticker on module) or universal(orange sticker on module)

Convertible C1 same outward appearance as the original Mini, but 2 removable jumpers on terminals inside the module. The C1 is convertible for all GM 87 or 90mm TBs.

C2 has a green tab in the top of the module, no jumpers. The C2 should be used with GM LS3 style 90mm gold blade throttle bodies.

The majority of issues we hear about are with engine swaps and transplants. Ensure that all wiring, ground connections and power up sequences are correct. The PCM and TAC module must be powered and shutdown together. Ensure that matching parts have been used. e.g.2003-2005 truck PCM/TAC module and pedal will work together, but are not compatible with 2006-2007 parts.

**For all error conditions:** first check that all connectors are secure and dry at the throttle body, TAC module and pedal assembly, ensure that the battery is fully charged, check for bent terminals, damaged wiring/insulation and shorts anywhere in the throttle control system wiring. Remove the purple clips from the backs of the connectors and tug on each wire to ensure that none have pulled out of the terminals. Ensure that the PCM is loaded with the proper calibration for the vehicle year/model (or installed powertrain), confirm that throttle actuator system components (pedal assembly, TAC module, PCM) are of the same application and model year, **confirm that all engine to battery and harness to block ground connections are secure, particularly the engine harness ground at the top right of the block just behind the intake.** Check for internal breaks in wires by watching for insulation stretch while pulling firmly on the wire a few inches back from the connector.

For the **X-Link 2.1** version only - ensure that the pink wires are cut \*\* if you are using a car-style LS2/LS7 90mm throttle body with an aluminum colored blade.

For **X-Link Mini** ensure that you have the correct version(gold/silver blade) for your throttle body.

For **C1 Convertible Mini** ensure that both jumpers are installed for use with GM/ACDelco gold blade or Nick Williams throttle bodies, and that they are installed in the **correct orientation**. The jumpers should be removed for use with GM/ACDelco silver blade 90mm throttle bodies. Check that the **jumpers fit snugly** on the pins. If loose, spread the pins slightly for a tighter fit.

Ensure that your throttle body is genuine GM/ACDelco. Clones with magnetic sensors are not compatible with these vehicles.

Disconnect any trigger wires that you may have wired into the throttle position sensor circuits. An alternative is to use the APP sensor1 circuit for this purpose. The TAC module is mounted on the driver's side firewall under the corner brace. There are 2 connectors plugged into the bottom of it, one 10 pin and one 16 pin. The APP sensor 1 signal is the dark blue wire on the 10 pin connector.

Ensure that the expected airflow tables in the vehicle calibration (tune) are adequate if engine displacement has been increased or forced induction has been added. **Changes to the throttle response tables, Trans Abuse and other torque limiting tables have also been known to cause issues.** If you are experiencing limited throttle opening with no DTCs being set, log the commanded/desired ETC throttle position and the actual ETC TP. If they match, it is likely that a torque limiter in the tune is triggering your problem.

### **Additional Checks for Specific Throttle-Related Diagnostic Trouble Codes (DTC's)**

**U0107** (Lost or scrambled serial data communication between the PCM and the Throttle Actuator Control Module)- This most commonly results from a missing, weak or intermittent ground connection between the engine wiring harness and the top, right, rear of the engine block. Check the connection point and check for any internal breaks in the wiring between the TAC Module and that point. Other possible causes include; a short or break in one of the 2 data communication wires between the TAC module and the PCM, an intermittent in the 12 volt supply to the TAC module, or wiring changes that result in the PCM being powered up before the TAC module.

**P1514, P1515, P1516, P2101 = unable to achieve or hold desired throttle position.** This can be caused by anything that impedes the throttle blade from moving or holding steady. Most commonly this is caused by a partial break in the yellow or brown wires near the factory 8 pin connector(GM has a service bulletin about this). These heavier gauge wires seem to be more prone to breaking from vibration over time than the other wires. This causes a weak throttle motor. A poor engine harness ground wire connection, or internal break in the wire, can also cause this(black wire, top, right rear of engine block just behind the intake). Both TPS signals being out of range or lost will also cause a P1516. This would most likely occur with a bad TPS sensor and is more common with the earlier truck style 87mm throttle bodies. P1516 may also set if an incorrect throttle area scalar is set in the tune. Predicted airflow vs throttle position will not match the values in the tune.

**X-Link 2.1** - ensure that the two pink wires on the have not been cut if you are using the truck-style 87mm throttle body or the LS3 90mm throttle body with gold colored blades.

**Check battery negative connection to the engine block.**

Check for 5.0V to the throttle position sensor circuit (grey wire) without the X-Link connected. Ensure that you have the most recent version of the vehicle calibration installed (there is a TSB concerning this issue for some model years) and that the expected airflow and throttle response tables are appropriate to the application.

Other possible causes are; the throttle blade hitting the stop at wide open throttle, a weak battery, a bad sensor in the 87mm throttle bodies, turbulent airflow under boost, binding/rubbing of the throttle blade in the throttle bore.

**P1518- Check grounds**, ensure a good connection between the engine harness grounds and the engine block, particularly the connection at the right, rear, top of the block. An intermittent connection at one of the ground splices in the engine harness itself or a poor ground at the driver's side frame rail may also cause P1518 to set (see GM service bulletins below). Also check that the grounds to the block behind the power steering pump are clean and secure.

A bad Ignition 1 relay or ignition switch can also cause a P1518 to set at key-on.

**P0120 with P0220-** see: **"For all error conditions"** above

**P0220 alone- See P1518** and check **X-Link, Throttle Body**

**X-Link ohm tests:** measure resistance between the same-colored leads on the two connectors of the **X-Link:** Black to Black, Green to Green, Yellow to Yellow, and Brown to Brown should all be near 0 ohms.

**X-Link 2.1-** Grey to Grey should be 118 ohms if the pink wires are cut, 34 ohms if not cut, Purple to Purple should be 19.3 Kohms

**X-Link 3.0-** Grey to Grey is 34 ohms, orange to purple is 19.5 Kohms

**X-Links 3.5, 4.0 -** Grey to Grey is 0 ohms, orange to purple is 20.8 Kohms

There should be no continuity between any of the circuits and the metal enclosure.

**X-Link Mini-** Pink to Grey is 47 ohms on early or universal version, 118 ohms on LS2(silver) version, 0 ohms on gold blade version. Orange to Purple 19.X Kohms.

**X-Link Mini C1 Convertible-** Orange to Purple 19.X Kohms, Orange to White 24.3X Kohms, White to Purple 8.45 Kohms. Pink to Grey is 0 ohms with jumpers, 118 ohms without jumpers.

**Throttle Body tests:** Throttle position sensor output minimum values should not go below 0.35V when the blade is held fully closed/open by hand. TPS signals should not have any dead spots when the blade is moved through its full range.

**P2135-** sets whenever the TPS1 and TPS2 signals disagree; investigation should be based on the accompanying DTC's if present. If no other codes are set, check that no trigger circuits are tapped into the throttle sensor wiring, **check engine harness ground to block**, check battery/charging system, check for 5V to throttle position sensors(gray wire).

**Reduced Engine Power Mode with No DTCs Set-** check vehicle calibration/tune, particularly tables related to airflow at lower RPM (high load) on supercharged engines. Or there may be a tune file – PCM mismatch.

If no faults are found after the preceding checks, the throttle body or TAC module may be defective.

**The following relevant TSBs concerning throttle operation have been released by General Motors:**

### **Throttle-Related TSBs**

#### **1**

**Condition/Concern:**

Customers may have a concern of lack of power and engine light on. DTCs set will almost always contain a P1518 and may contain any of the following (P1516, P2108, P0220, P0120, U0107). An improperly torqued TAC module ground may be at fault. The Ground is listed as G104 on TAC module schematic which is incorrectly labelled on SI document ID 855376. The correct ground is G103. The locator for SI states that G103 is located on the left hand side which is incorrect. However, there have been field reports stating that G104 has also corrected this condition. G104 is a horizontal bolt in the rear of the left head and extremely difficult to reach. G104 should also be tightened at the same time.

There have also been field cases where ground G110 on the outer drivers side frame rail (under the drivers foot/floor area) caused a P1518 code and an intermittent connection at splice 102 on the intake.

All published SI diagnostics should be followed in addition to following the recommendation listed.

**Recommendation/Instructions:**

Tighten ground G103 located behind the right cylinder head (passenger side) just below the head and mounted into the block. The ground uses a 13 mm bolt head mounted vertically to the engine block just above the bell housing.

#### **2**

**SES Light and Reduced Engine Power with a DTC P1516: DTCs P0120, P0220, P1514, P1515, P1518 and P2135 May (or may not) Be Present; 04 Trucks and Utilities with GENIII V-8 Engines - kw 4.8 5.3 6.0 #PIP3089 - (Jul 30, 2004)**

SES Light and Reduced Engine Power with a DTC P1516: DTCs P0120, P0220, P1514, P1515, P1518 and P2135 May Also Be Present

The following diagnosis might be helpful if the vehicle exhibits the symptom described in the PI.

Condition/Concern:

SES light and reduced engine power with a DTC P1516. DTCS P0120, P0220, P1514, P1515, P1518 and P2135 may also be present.

Recommendation/Instructions:

If the SI diagnostics do not isolate the cause, inspect the Yellow TAC Motor Control Circuit (581) about 1 inch to 4 inches from the throttle body connector to see if it is broken inside of the insulation. Repair as necessary.

Please follow this diagnosis process thoroughly and complete each step. If the condition exhibited is resolved without completing every step, the remaining steps do not need to be performed. If these steps do not resolve the condition, please contact GM TAC for further diagnostic assistance.

Models:

(03 - 04 Cadillac Escalade C1, C6, K1, K6) and (03 - 04 Chevrolet Avalanche C1, K1, C2, K2) and (03 - 04 Chevrolet Silverado Truck C1, K1, C2, K2, C3, K3 ) and (03 - 04 Chevrolet Tahoe C1, K1 ) and (03 - 04 Chevrolet Suburban C1, K1, C2, K2, C3, K3 ) and (03 - 04 GMC Sierra Truck C1, K1, C2, K2, C3, K3 ) and (03 - 04 GMC Yukon C1, K1 ) and (03 - 04 GMC Yukon XL C1, K1, C2, K2, C3, K3) and (03 - 04 Hummer H2 N2 ) and (03 - 04 Buick Rainier S1, T1 ) and (03 - 04 Chevrolet Trail Blazer EXT S1, T1 ) and (03 - 04 GMC Envoy XL XUV S1, T1)

**Subject:LR4, LY2, L33, LH6, LM7, L59, LC9, LMG, LY5, LS2,LQ9, LQ4, L76, LY6 Throttle Actuator Control (TAC) Module Codes, MIL/SES DTCs P2108 P1516, U0107, Reduced Engine Power (Reprogram PCM) #06-06-04-042A - (09/25/2006) Models:2006-2007 Cadillac Escalade Models 2006-2007 Chevrolet Avalanche, Express 1500/2500/3500, Silverado, Silverado Flex Fuel, Silverado Hybrid, Silverado SS, Silverado 2500/3500 HD, Suburban, Tahoe, W3500/W4500 Series Medium Duty Tilt Cab**

**2006-2007 GMC Savana 1500/2500/3500, Sierra, Sierra Flex Fuel, Sierra Hybrid, Sierra Performance Edition, Sierra 2500/3500 HD, Yukon Models, W3500/4500 Series Medium Duty Tilt Cab**

**2006-2007 HUMMER H2, H2 SUT with GEN III or GEN IV Vortec V8 4.8L, 5.3L or 6.0L Engine (VINs V, C, B, M, T, Z, 3, 0, J, H, N, U, Y, K -- RPOs LR4, LY2, L33, LH6, LM7, L59, LC9, LMG, LY5, LS2, LQ9, LQ4, L76, LY6)**

**This bulletin is being revised to add the 2007 model year and engines. Please discard Corporate Bulletin Number 06-06-04-042 (Section 06 -- Engine/Propulsion System).**

Condition

Some customers may experience engine operation in the Reduced Engine Power mode, an MIL/SES light on and DTCs P2108, P1516, and U0107 set.

Cause

This condition may be caused by an error in the TAC Module communication software.

Correction

**Diagnostics Aids:**

- Using the scan tool, check the Freeze Frame/Failure record for Engine Run Time and Vehicle Speed at the time the DTC occurred. If the above concern is encountered at start up and the vehicle speed is at zero, *Do Not* replace the TAC module for this condition. Refer to this bulletin for reprogramming the PCM.
- If the Freeze Frame/Failure record indicates that the DTC occurred while driving, the condition may have been caused by static electricity resulting from improperly grounded equipment. If the vehicle has been upfitted with a ladder rack, utility bed or similar equipment, install a ground strap between the frame and the upfitted equipment, then evaluate repairs. If pulling a trailer, proper trailer grounds must be installed according to the instructions in the Owners Manual.

- If the DTCs occur while the vehicle is in motion (speed greater than zero) and there is no apparent source of static electricity, proceed with diagnosis according to DTC P2108 service procedure in SI.

### **PCM Reprogramming Instruction (if indicated from Diagnostic Aids)**

Reprogram the PCM with the latest calibrations if the above concern is encountered. An updated PCM calibration is now available to address this concern. This calibration, or any that follow, is designed to address this concern. Refer to Service Programming System (SPS) using the appropriate Service Information (SI) procedures. The new PCM calibrations will be available to dealerships as part of TIS2000 incremental satellite update version 8.5, which was broadcast to dealers on 08/20/2006. For the dealerships that use CDs, the CD version will be 8.5 for 2006, which will be mailed 08/24/2006. As always, make sure your Tech 2® is updated with the latest software version.

## **4**

### **Condition/Concern:**

A vehicle may be brought into the dealer for a reduced power message, and DTCs P0120, P0220, P1516, P2101, or P2135.

The Throttle Actuator Control (TAC) / throttle body type trouble codes, may be caused by a loose wiring crimp at the throttle body connector, or a broken throttle body circuit.

### **Recommendation/Instructions:**

Complete the current SI diagnostics for any symptoms or trouble codes found. If a intermittent T/P or TAC module type code is occurring complete the inspections below.

- 1.** Inspect all related throttle body terminals for a loose wiring crimp. The loose crimp may be difficult to find, and the poor connection will be between the terminal and the copper strands of the wire. Wiggle test the individual throttle body circuits to see if the concern can be duplicated.
- 2.** Inspect the related circuits for broken wires inside the insulation. The outer wire insulation may look fine, but the internal copper strands may be partially broken. Breaks in the wires usually occur within 1 to 4 inches of the throttle body connector. Wiggle testing may also induce a trouble code to set.
- 3.** On C/K trucks complete SI procedures for voltage drop on grounds G103 and G104. Grounds G103 or G104 may be loose or corroded.

If a terminal crimp or a broken wire has been found, repair or replace only the circuits involved. There is a throttle body pigtail connector available through GMSPO, but installing this pigtail connector may cause other intermittent TAC module/TP codes at a later date. If this pigtail must be used, please follow

the SI procedures for Splicing Copper Wire Using Splice Sleeves. (the proper Kent-Moore crimping tool must be used for this repair)