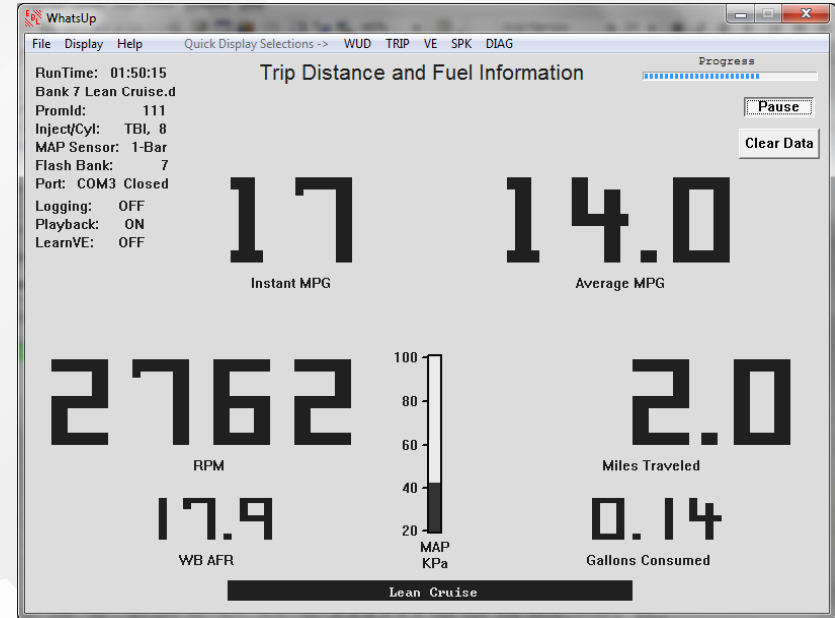
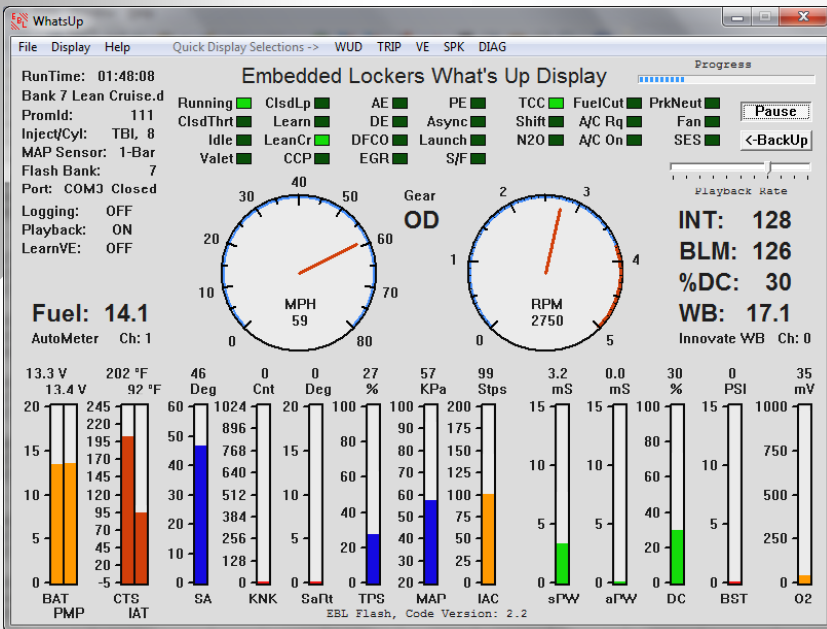




“What’s Up” with Electronic Fuel Injection



Presenters: Randy Van Winkle
Bob Drewes

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Shade Tree Guys



Gas Engine Basics

- No free lunch
- What a carburetor does
- What fuel injection does
- How cars cool the combustion
- How cars get good mileage
- Carbs are not bad
- Spark is important

Objectives

- Evolution of EFI on the GMC
- EFI Components
- EBL Operation
- Tuning
- Going for Better mpg
- Mr. EFI - Bob Drewes
 - Better Idling
 - Making sure to use Correct Distributor Components

Evolution of EFI in the GMC Community

Fuel Management

•Howell, AFI, Turbo City

Spark Control (ESC)

•Distributor from 307 Olds

Vehicle Speed Sensor (VSS)

Enhanced ECM with EBL

Toys – WB-O2, EGT, FP, special displays

Port Injection

☀ If starting from scratch, consider? ...

- RYO TBI with EBL add-on (less expensive option)
- Howell, AFI with EBL add-on
- Holley
- Edelbrock
- FAST
- MegaSquirt

Support Resources Available



- ★ Google Groups for GMC EFI discussion
 - ★ Discussion of common problems and solutions
 - ★ Over 90 members
 - ★ <http://groups.google.com/group/gmcmh-efi>
- ★ Detailed Help with Tuning
<<https://sites.google.com/site/gmcmhefi/>>
 - ★ Tweaks – common procedures with detailed instructions for specific EBL parameters
 - ★ Tips – items of interest
 - ★ Files - A place to upload and share log files, images or other files of interest

EFI Components

- ★ Throttle Body Injection (TBI)
 - ★ Need at least a 2" bore
- ★ Idle Air Control (IAC)
- ★ Throttle Position Sensor (TPS)
- ★ Manifold Absolute Pressure (MAP) Sensor
- ★ O2 sensor
- ★ Electronic Control Module (ECM)
- ★ Computer Controlled Distributor (CCD)
- ★ Knock Sensor (KS) & Electronic Spark Control (ESC)
- ★ Vehicle Speed Sensor (VSS)
- ★ Software with ability to make changes to ECM programs

What is EBL?

- 3rd gen hot-rodders
 - Most used 7747 ECU
 - Needed more control and easier tuning capabilities
- Add-on board with modern day capability
- Ease of chip updating (no chip burner)
- Self-tuning capability for fuel management
- What's Up Display (WUD) to enhance monitoring
- Additional functionality (lean cruise, etc.)



EBL Operation

- ★ What's up display (WUD)
 - ★ Main display
 - ★ mph and rpm displays
 - ★ Indicators for idle, closed loop, PE, DFCO, etc.
 - ★ Gauges displaying information from sensors
 - ★ Trip screen - distance and fuel information
 - ★ Volumetric Efficiency (VE) learn screen
 - ★ Areas of spark knock screen
 - ★ Sensor diagnostics screen

WUD Link

Tuning - Tools

- ★ Tuner Pro – Freeware

- ★ <http://www.tunerpro.net/>

- ★ Laptop

- ★ Need to be able to run Windows

- ★ Many are using a Mac with ability to run windows – works without any problems.

- ★ iPad also works as a touch screen

- ★ Serial to USB adapter



Tuning – Additional Tools

- ★ Wideband Oxygen Sensor (WB-O2)
 - ★ DynamicEFI
 - ★ Innovate
 - ★ Zeitronic
- ★ Exhaust Gas Temperature (EGT)
- ★ Fuel Pressure Gauge (manual or electronic)



Tuning – Getting Started

- EBL came in the mail – now what?
- Determine which .bin to use
 - Several choices
 - CD comes with one for the 455
 - Ask for one matching your engine configuration



1. Unplug two plugs from old ECM and plug into EBL
2. Plug in laptop
3. Flash in new .bin



Tuning – VE Learns

- ★ VE learn is major feature of EBL
 - ★ With the original ECM (7747) one would generate a log then do some fairly complex calcs to arrive at new VE tables
 - ★ EBL does this process for you
 - ★ Does not update automatically – yet



DEMO

Tuning – Advanced



No getting your hands dirty
No getting out wrenches/screwdrivers



SA - Main Table

	20	30	40	50	60	70	75	80	85	90	95	100
4800	45.70	45.70	45.70	45.70	45.35	43.24	41.13	36.91	34.80	33.75	33.05	31.99
4400	45.70	45.70	45.70	45.70	45.35	43.24	40.43	36.91	34.80	33.75	33.05	31.99
4000	45.35	45.35	45.35	45.35	45.00	42.89	39.73	36.56	34.45	33.40	32.70	31.64
3600	45.00	45.00	45.00	45.00	44.65	42.54	39.38	36.21	34.10	33.05	32.34	31.29
3200	45.00	45.00	45.00	45.00	44.30	41.84	38.67	35.51	33.40	32.34	31.64	30.59
2800	45.00	45.00	45.00	45.00	43.95	40.78	37.62	34.80	32.70	31.29	30.59	29.53
2400	45.00	45.00	45.00	44.65	43.59	39.02	36.56	34.45	31.99	30.23	29.18	27.77
2200	45.00	45.00	45.00	44.30	42.89	37.97	35.51	33.75	31.64	29.53	28.48	27.07
2000	45.00	45.00	44.65	43.95	41.84	37.27	34.80	33.05	31.29	28.83	27.42	25.66
1800	45.00	45.00	43.95	43.24	40.43	36.21	34.80	32.70	30.94	28.13	26.72	24.96
1600	44.30	44.30	43.24	42.19	39.38	35.51	34.10	31.64	29.88	27.07	26.02	23.91
1400	42.54	42.54	41.48	40.78	37.97	34.45	33.05	30.94	28.83	26.02	24.96	23.55
1200	40.08	40.08	39.38	38.32	35.86	33.05	31.64	29.53	27.77	25.66	24.61	23.20
1000	35.51	35.51	35.16	34.45	33.05	30.94	29.88	27.77	26.37	23.55	23.20	22.50
800	30.59	30.59	30.59	29.53	28.48	26.72	26.02	24.61	23.20	20.74	20.39	20.04
600	29.18	29.18	29.18	28.13	25.66	24.61	23.91	21.80	21.45	18.98	18.63	18.28
400	26.72	26.02	24.96	24.26	23.55	22.85	22.50	20.74	20.39	17.93	17.58	17.58

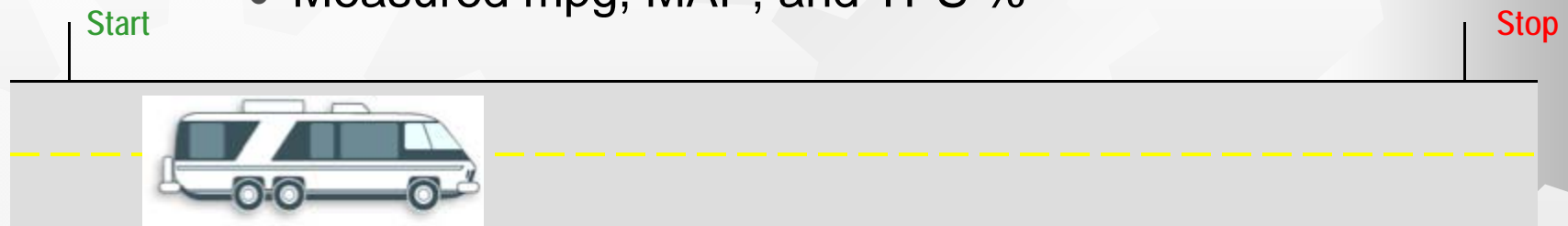
View Graph
Toolbox Compare
Save Cancel



Just change some table values
and give it a try

Tuning – Spark Control

- ★ Generally, spark should be knock limited
- ★ SA table and WUD display reflects actual crank SA
- ★ Tuning SA
 - ★ Looking for Maximum Brake Torque (MBT)
 - ★ Need a dyno but we are “shade tree” guys
 - ★ Laid out a 2 mile course
 - Ran course with CC
 - Measured mpg, MAP, and TPS %



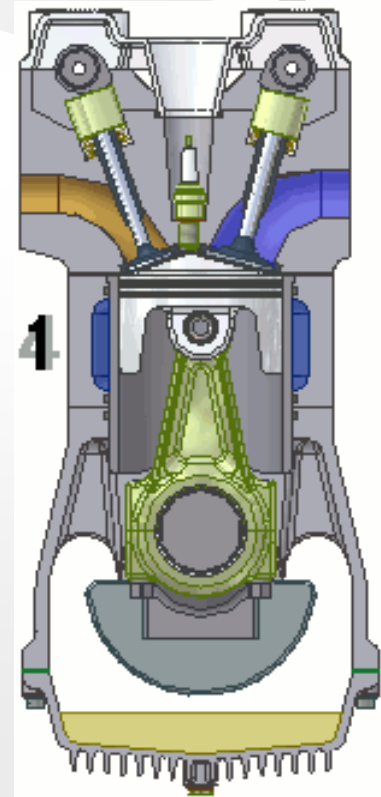
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Going For Better MPG



Going for Better MPG

- ★ Deceleration fuel cut off (DFCO)
- ★ Lean cruise (or HiWy mode)
 - ★ Controlled by mph, MAP and various time functions
 - ★ Set commanded AFR based on MAP
 - ★ 16.4:1 seems about right for 50 MAP
 - ★ Lower AFR as MAP increases
 - ★ Increase SA during lean cruise
 - ★ Parameter: SA-HiWy vs MAP
 - 5 degrees at 50 MAP seems about right
 - Decrease SA as MAP increases



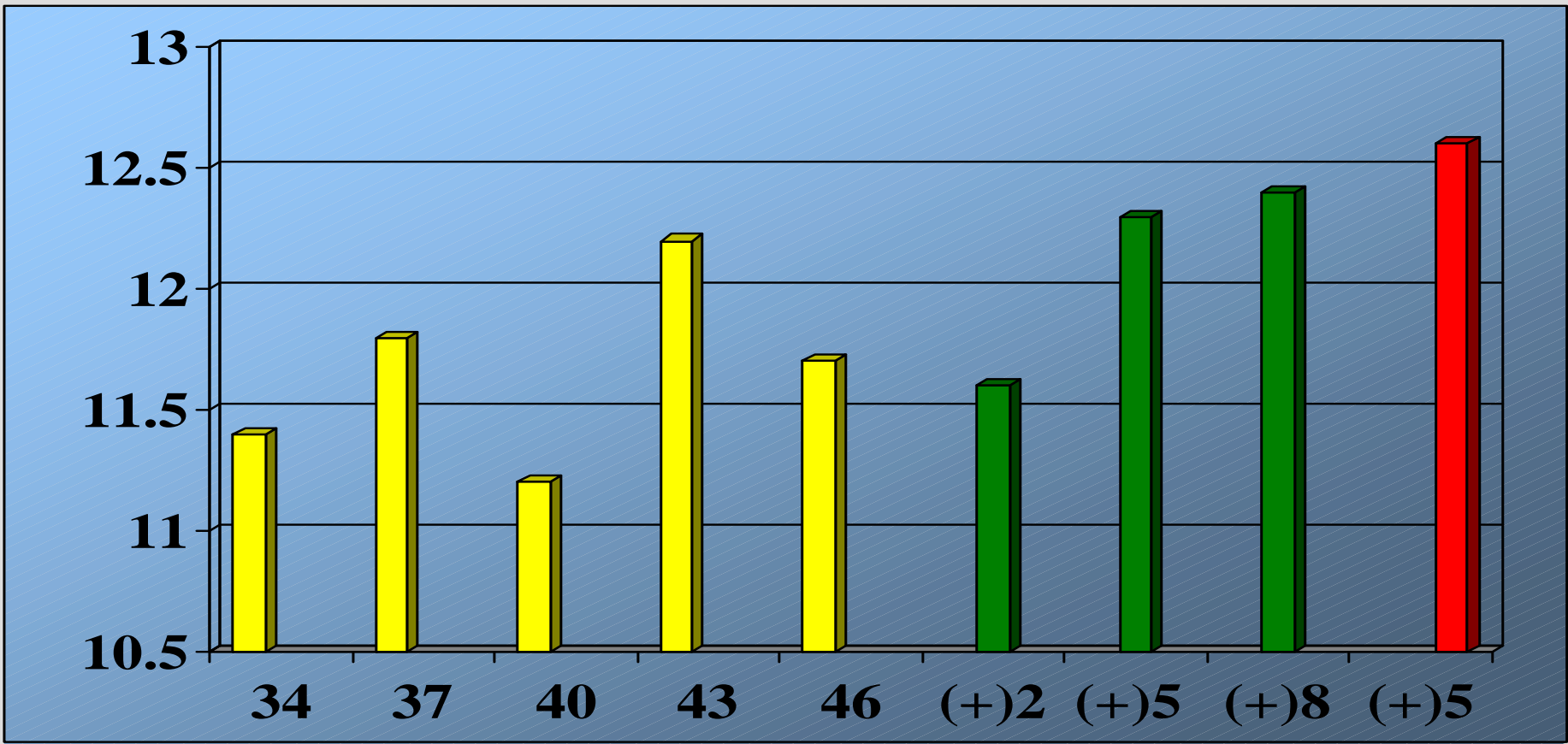


Going for Better MPG - Results

Start

26' Eleganza II 403 with 370 FD

Stop



■ MPG ■ HiWy ■ 16.4

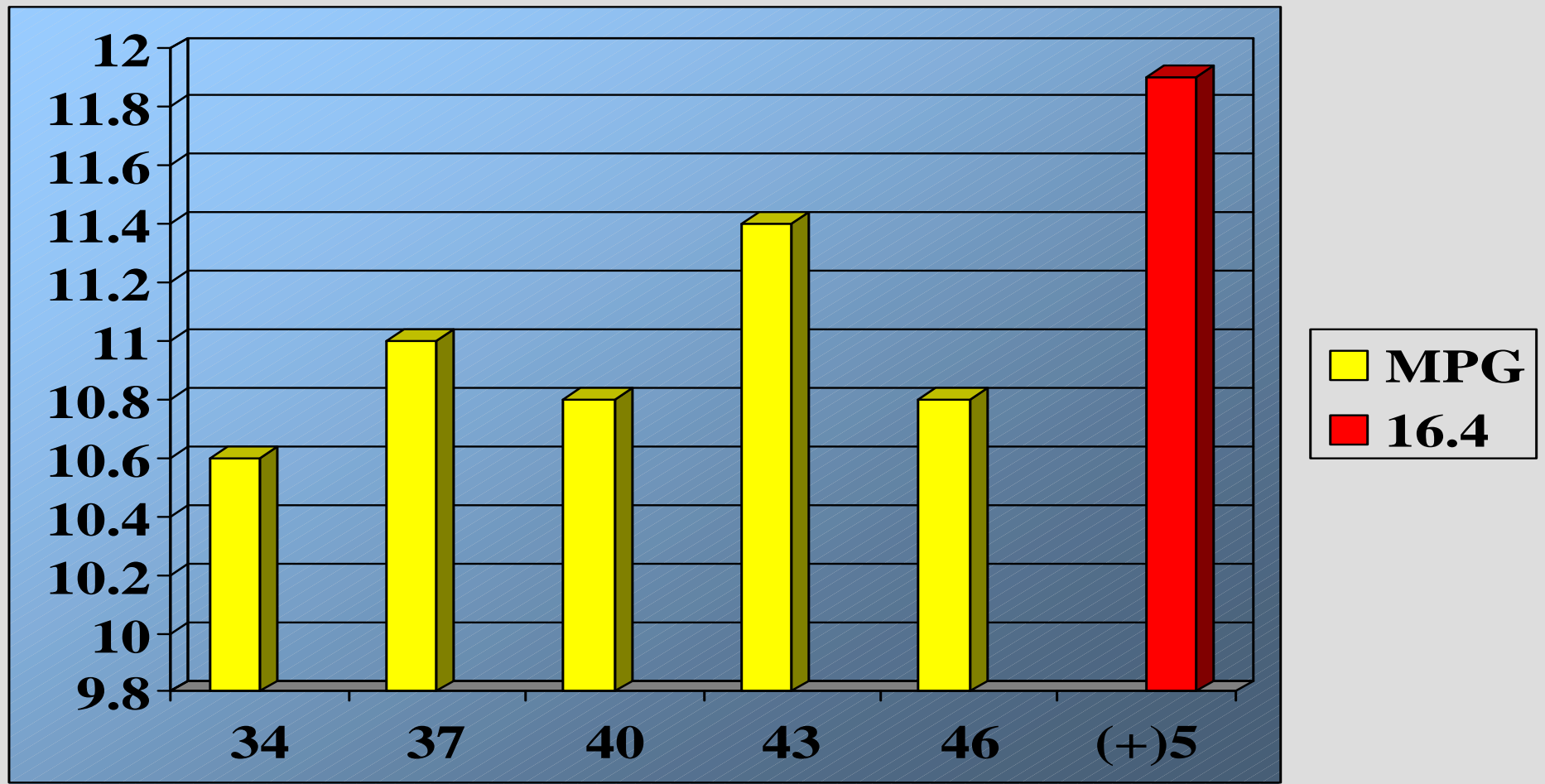


Going for Better MPG - Results

Start

26' Eleganza SE 455 with 307 FD

Stop



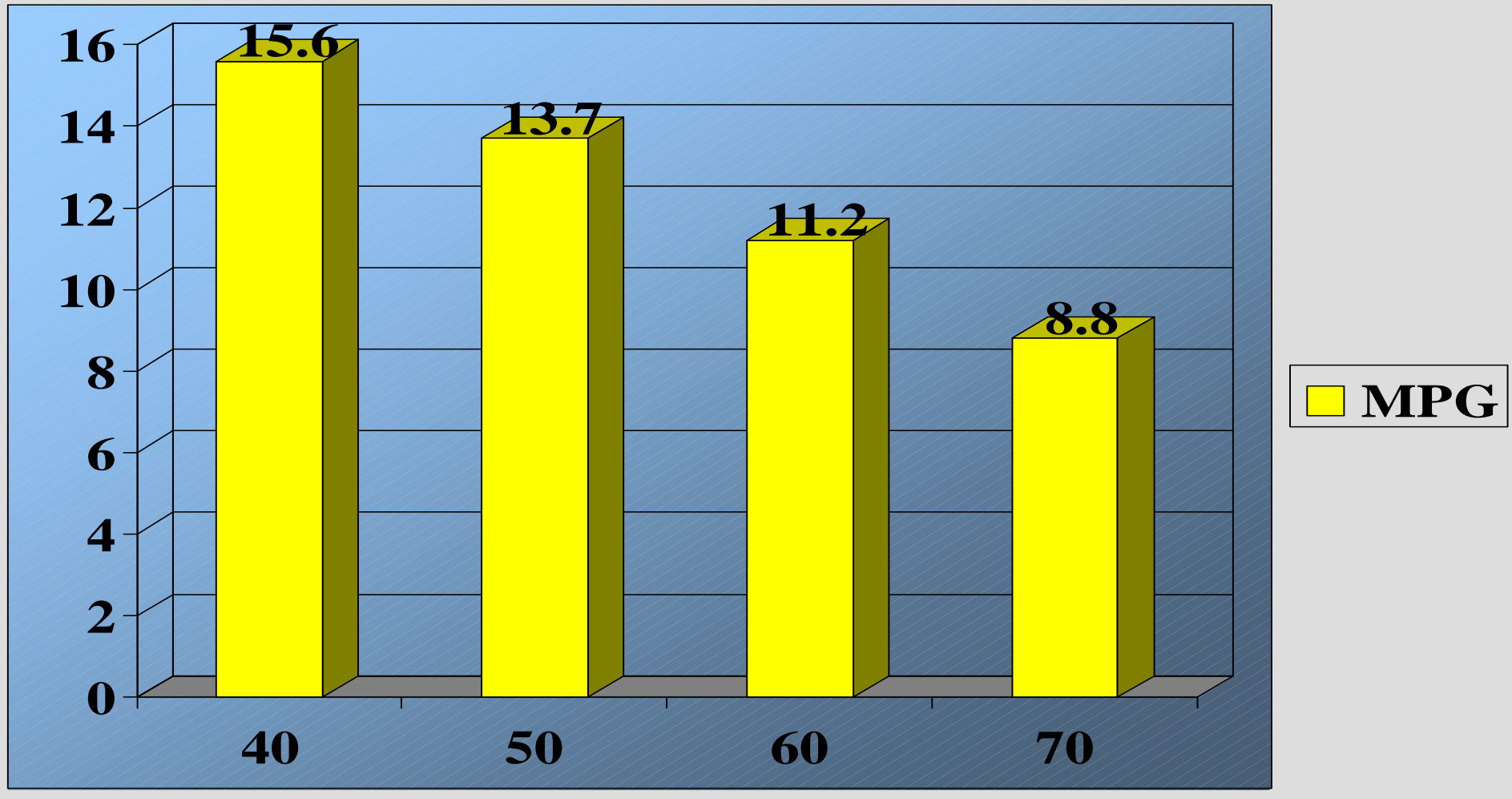


Speed Affects MPG

Start

26' Eleganza II 403 with 3.70 FD

Stop





Bob Drewes

TBI Calibration and Computer Controlled Distributor Components



April 12, 2011

GMCMHI Rally - Patterson

TBI Calibration

Why ?

The TBI needs to be matched to the engine it is used on. The ECM needs to know when the throttle plates are in the closed position and the voltage of the TPS (throttle position sensor)

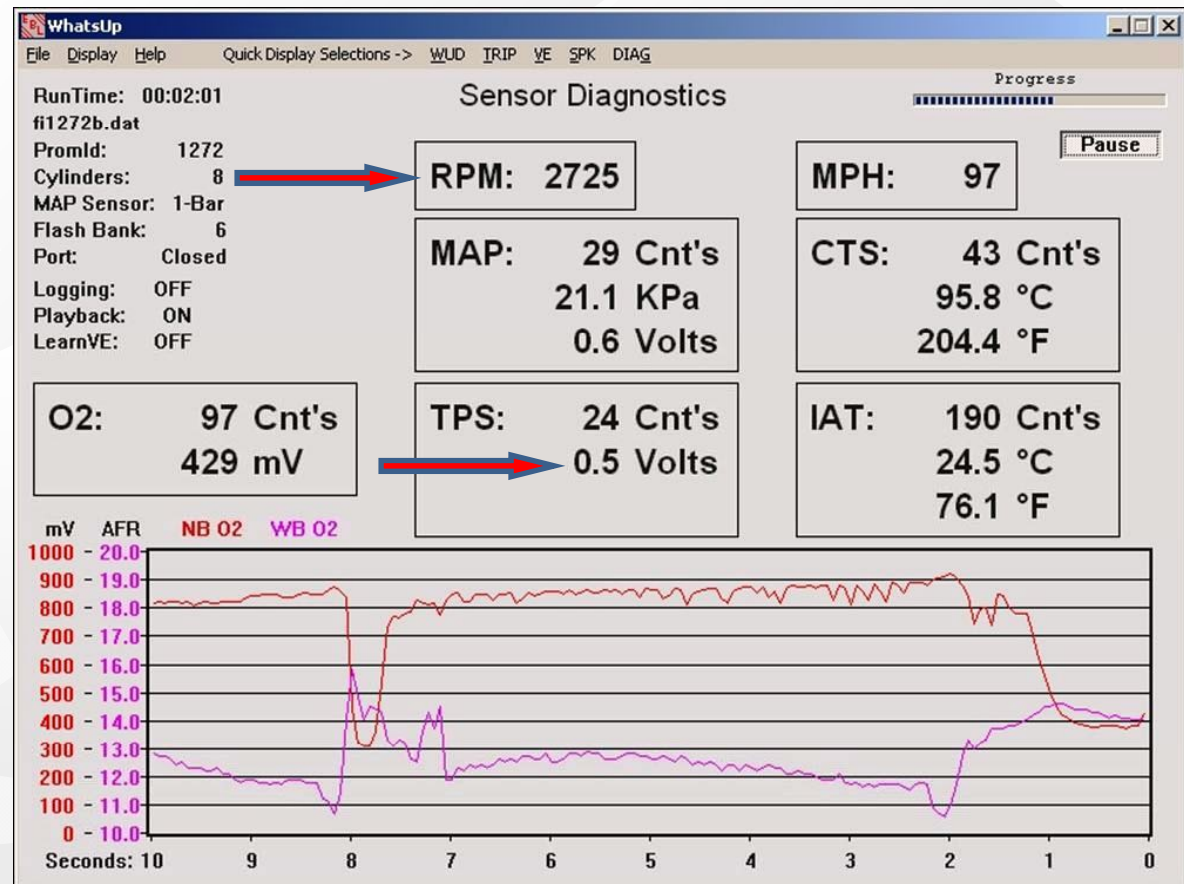
How do we do this ?

We do this by setting the “minimum idle speed” of the engine. After that adjustment is done, the IAC will control the engine idle speed from the engine idle tables in the ECM.

If you have NOT installed the EBL system, plug a scanner into the ALDL connector to get the sensor readings needed for the calibration. What is needed is engine RPM and TPS voltage.



If you have installed the EBL system then you can use the sensor diagnostics page of the WUD to view the sensor info needed to do the calibration.



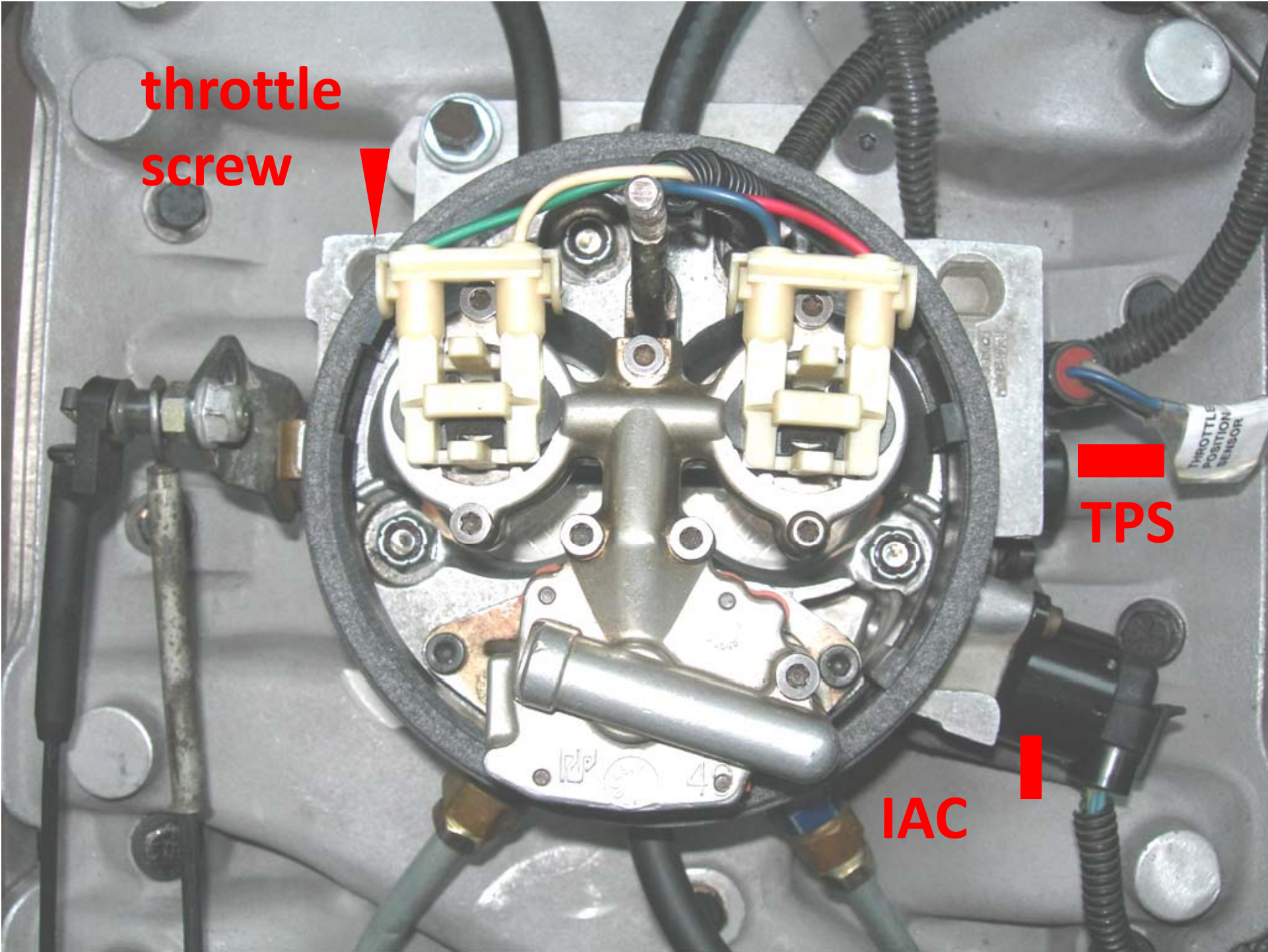
throttle
screw



TPS

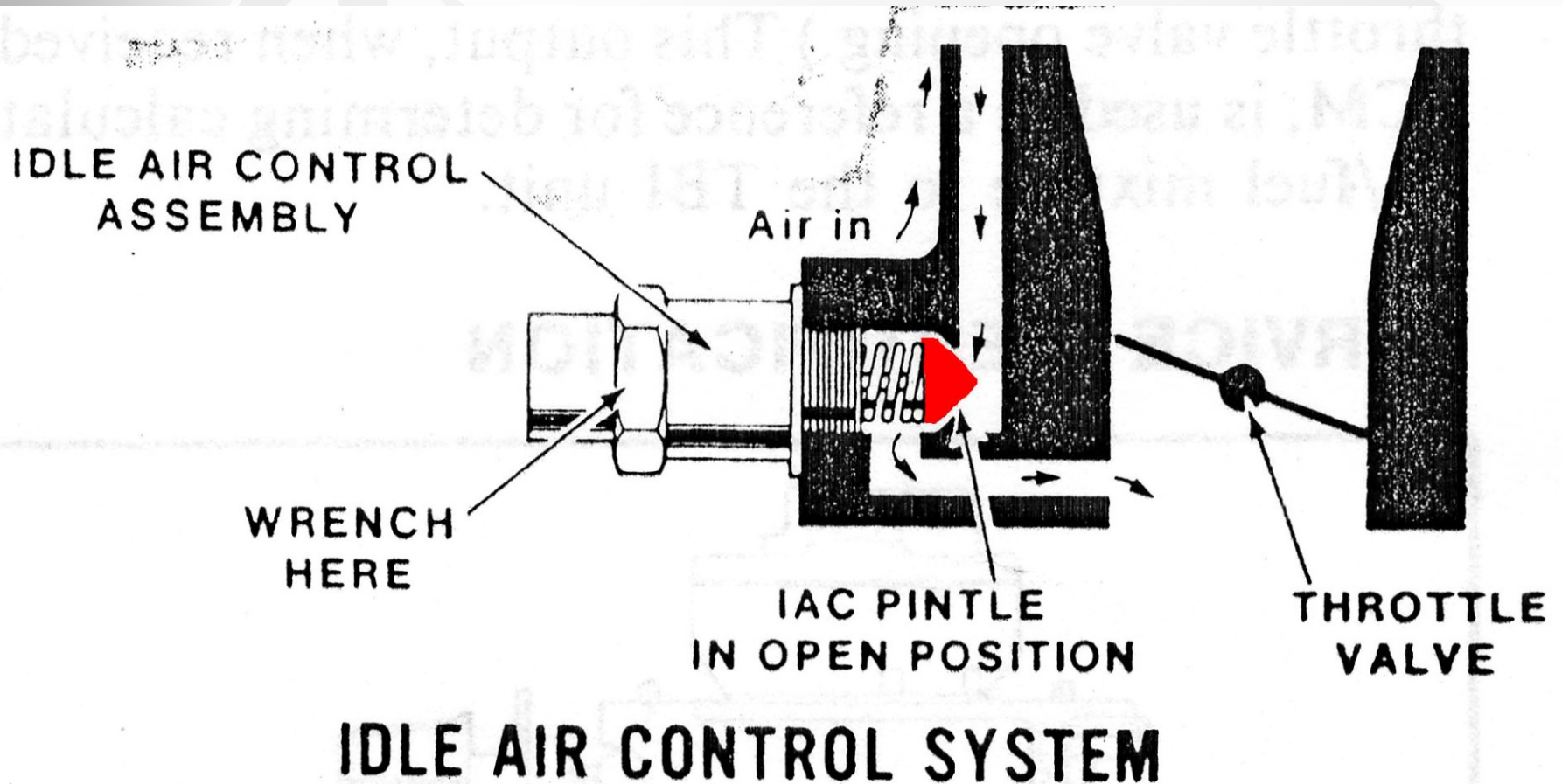


IAC



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The diagram below shows how the IAC control will by-pass the air around the throttle valves when the chip controls the IAC and the idle speed. In doing the calibration, we are going to move the IAC pintle into the seat, shutting off any by-pass airflow, and then disable the IAC. Then we will adjust the throttle plates for "minimum idle" speed.



How to calibrate the TBI

- 1-** Engine warmed up, key *OFF*, tranny in *PARK*
- 2-** Put a jumper wire from pin "A" to pin "B" on the ALDL connector (should be the black wire & white wire) A metal paper clip works good for this.



- 3-** Turn key to ON, do not start engine, wait 8 seconds. This will extend the IAC pintle and close off the air passage in the body of the TBI.

- 4-** Remove the electrical connection to the IAC by pulling it straight out. Turn the key to OFF and remove the jumper from the ALDL connector. The IAC is now seated and not controlling the idle speed.
- 5-** Start engine, and let it settle into idle speed. You may need to give it a little throttle to get it running. Turn the throttle screw until the idle RPM is 550-575.
- 6-** Turn engine OFF. Connect the IAC connector.
- 7-** Start engine and run for 5 seconds, turn engine OFF and wait at least 30 seconds. This will reset the IAC control.

8- Start engine, in PARK, let it idle. The IAC is now controlling the idle speed of the engine from the idle tables in the ECM.

Note: *It's best to have the IAC counts in the 10-15 count range, but they can vary some from this. You want TPS voltage at or around 0.60 volts.*

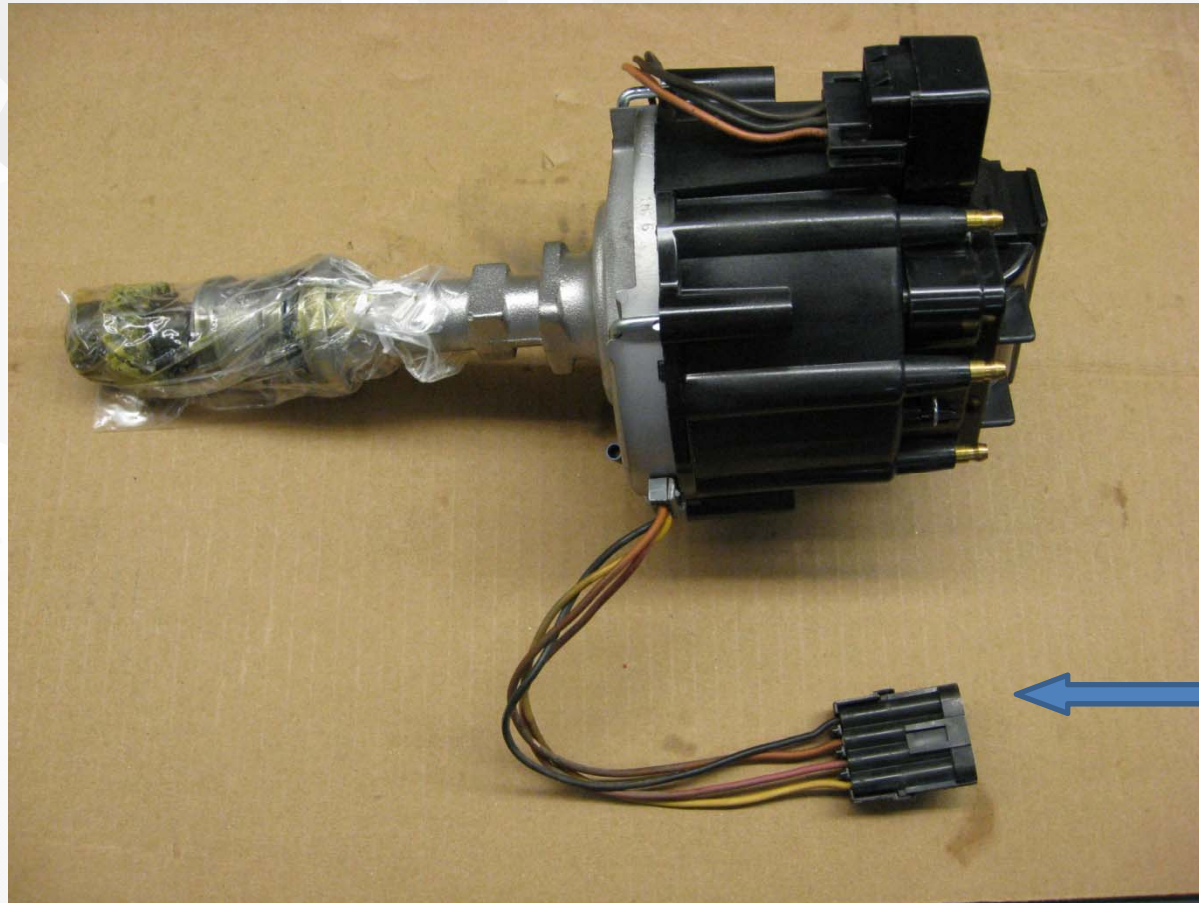
For more information on this procedure, check here:

<https://sites.google.com/site/gmcmhefi/ebl-tips-folder/ebl-tips---initial-iac-calibration> >



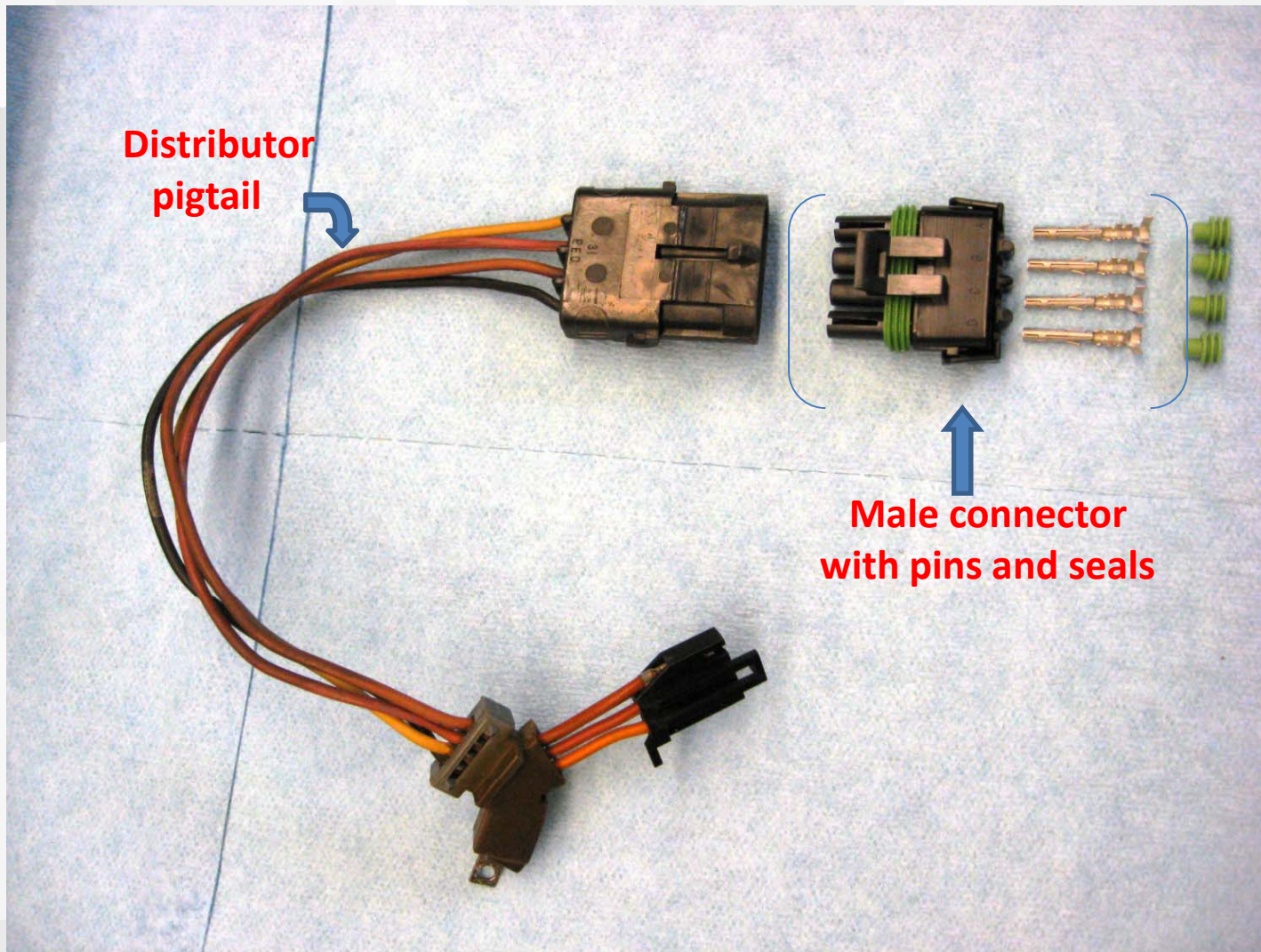
Computer Controlled Distributor

Used on the Oldsmobile 307-Y engines



OEM
Four wire
plug

Attach a male weatherpack connector to the TBI wiring harness to connect to the distributor pigtail

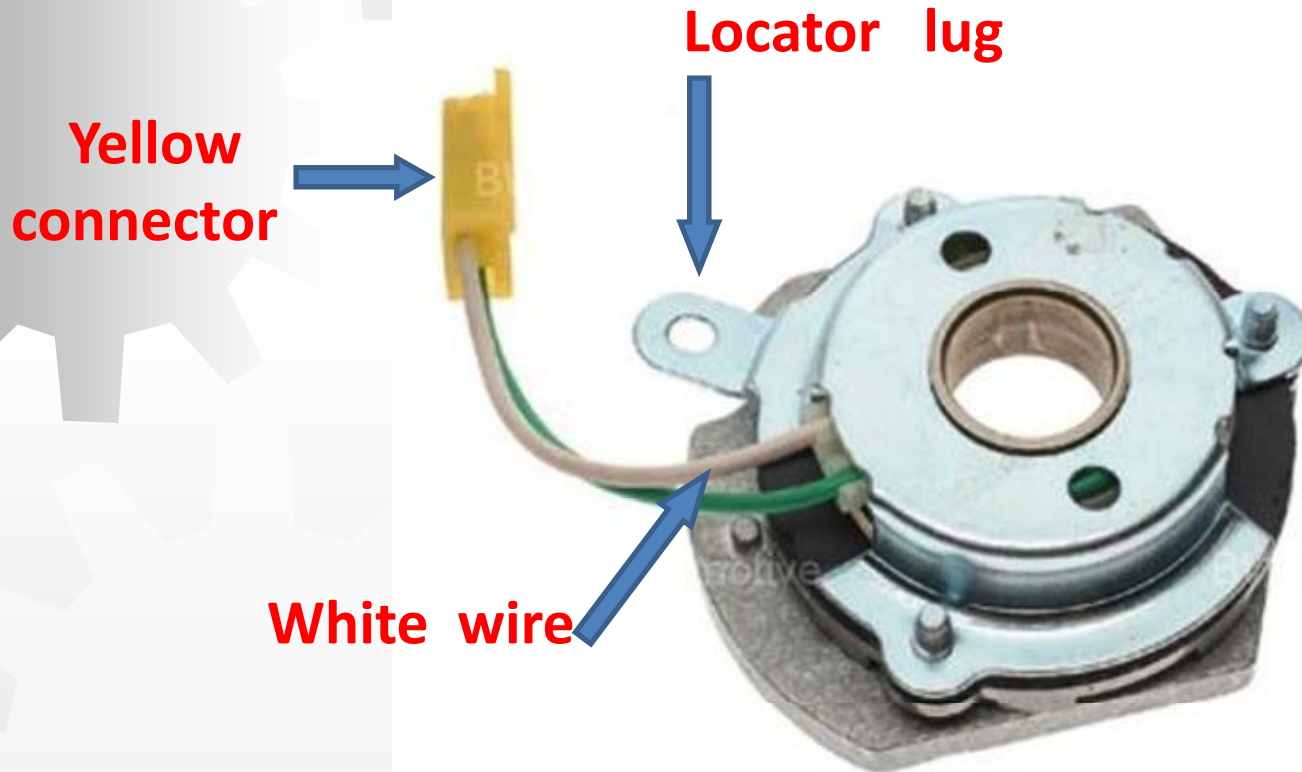


The ignition coil and the pick-up pole piece in the distributor need to be matched. Use the ignition coil with the **YELLOW** and **RED** wires

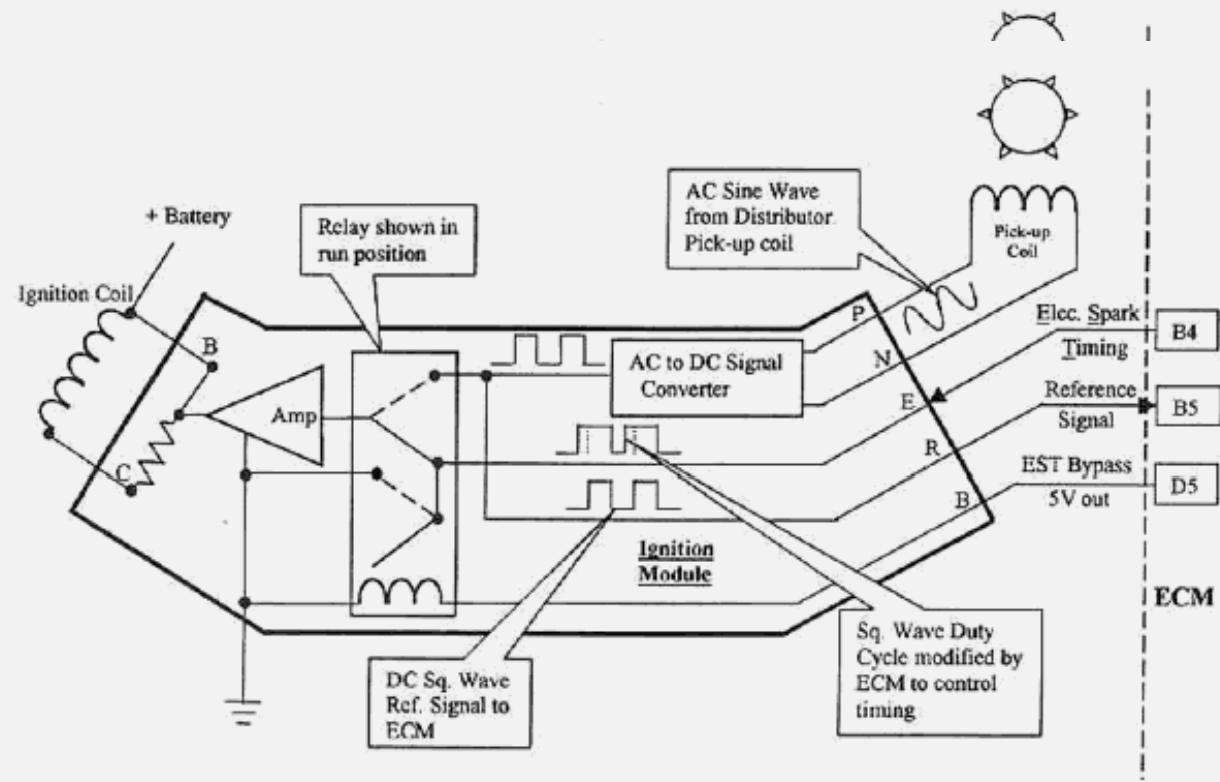
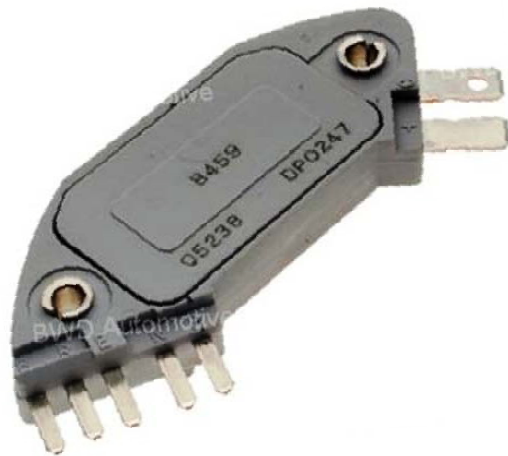


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The pick-up pole piece needs to match the ignition coil. The WHITE wire needs to be closest to the locator lug that index's the pole piece to the distributor. The wires will have a YELLOW connector or cable tie.



The seven pin module that is mounted in the distributor, receives signals from the ECM spark tables and controls the spark to the engine



Follow - up

- ★ Read EBL – Tweaks on the Google Pages
 - ★ <https://sites.google.com/site/gmcmhefi/>
 - ★ Ask questions on the Google Group discussions
 - ★ <http://groups.google.com/group/gmcmh-efi>
- ★ Catch Randy or myself during the remainder of the Rally

Tuning

Additional Details

or

Too boring for the main show

Tuning – Getting Started

- ★ EBL came in the mail – now what?
 - ★ Determine which .bin to use
 - ★ If you have a fuel pressure gauge, check FP – adjust to get approx. 70 - 74 pph injector capability
 - ★ Calculate BPC value to use
 - ★ Utility provided with EBL
 - ★ Set initial SA (SA-Initial SA)
 - ★ Should be the same as set at the crank. Set the physical / static timing by disconnecting the “brown” wire.
 - ★ Most are using 6 degrees
 - Current thinking is to up this to 8 or 10 degrees
 - ★ Confirm airflow setting – displacement scalar
- ★ Flash in new .bin
- ★ Start her up!

Tuning – Next Steps

- ★ Log test run (keep it fairly short)
- ★ Watch playback or review log paying particular attention to BLMs
 - ★ If values are generally more than +/- 10 from 128 then:
 - ★ Adjust BPC
 - Low BLM means computer is removing fuel – lower BPC value
 - High BLM means computer is adding fuel – raise BPC value
- ★ Flash updated .bin
- ★ Generate more test data
 - ★ Review BLMs
 - ★ If BLMs approaching +/- 10 of 128 then ready for VE learns

Tuning – Additional To-dos

★ Check VE tables

- ★ Values should not exceed 100%
 - ★ Ideally, upper numbers should be 85-90%
- ★ If adjustment needed
 - ★ Lower entries by 10% across the board
 - ★ Raise BPC values by 10%
- ★ Perform test runs with VE learns

★ Check injector duty cycle (DC)

- ★ 2nd gear at 3000 RPM – accelerate quickly up to 3200 – 3300
- ★ Maximum DC of 85% considered optimal
- ★ If DC approaches 100% then need to raise FP

Going for Better MPG - DFCO

★ Deceleration fuel cut-off

- ★ Shuts off injectors when coasting
 - ★ Especially good for long downgrades
 - ★ Effective for slowing from speed down to a stop
- ★ Controlled by several factors
 - ★ RPMs
 - Must be above set rpm to enter
 - Exits when below set rpm
 - ★ Map
 - Must be below set MAP to enter
 - Exits when above set MAP
 - ★ Mph
 - Must be above set mph to enter
 - Exits when below set mph