

ACCEL/DFI Engine Management Systems

DFI Generation 7.0+

Installation and Operation Manual

CalMap®
Gen 7+
PROFESSIONAL
DFI
Digital Fuel Injection
Engine Management Systems

GEN 7 DFI

Right-Click for Communication Options

- Online to ECM
- Offline from FILE
- Exit Calmap

32 Bit Software -- With Patented Real-Time Data Editing and Parallel Multiprocessing. Protected by U.S. Patent # 5091858

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ACCEL/DFI Products and Part Numbers

Spark/Fuel Kits

77022	GEN VII CHEVY SPARK/FUEL (EXCEPT LT1)
77022-L	GEN VII CHEVY SPARK/FUEL LT1
77025	GEN VII BUICK/GN V6 SPK FUEL KIT
77025-U	GEN VII UNIVERSAL V6 CYL KIT W/UNIV IGN
77026	GEN VII UNIVERSAL 4 CYL SPK/FUEL
77027	GEN VII UNIVERSAL 4 CYL KIT W/IAC
77030	GEN VII FORD 5.0 TFI SPK/FUEL
77030-U	GEN VII FORD 5.0 W/UNIV IGN SPK/FUEL
77030-E	GEN VII FORD (4.6L EDIS STRATEGY)
77040	GEN VII UNIVERSAL SPARK/FUEL KIT

ECM Only

77041	GEN VII FORD ECU ONLY
77042	GEN VII IPU ECU ONLY
77046	GEN VII GM ECU ONLY
77046-S	GEN VII GM ECU, STANDARD SOFTWARE KEY & COMM. CABLE
77046-P	GEN VII GM ECU, PRO SOFTWARE KEY & COMM. CABLE
77048	GEN VII UNIVERSAL 4 CYL ECU ONLY

Complete Manifold & Electronic Systems

77102	GEN VII CHEVY BB SUPER RAM RECTANGLE PORT
77102-H	GEN VII CHEVY BB HIGH OUTPUT SUPER RAM RECTANGLE PORT
77106	GEN VII CHEVY BB SUPER RAM OVAL PORT
77130	GEN VII CHEVY SB STREET RAM SYSTEM
77131	GEN VII CHEVY SB SUPER RAM
77131-H	GEN VII CHEVY SB HIGH OUTPUT SUPER RAM
77135	GEN VII UNIVERSAL THROTTLE BODY INJECTION SYSTEM
77141	GEN VII CHEVY SB PRO RAM 500 HP 750 CFM
77142	GEN VII CHEVY SB PRO RAM 750 CFM IPU
77143	GEN VII CHEVY SB PRO RAM 1200 CFM
77144	GEN VII CHEVY SB PRO RAM 1200 CFM IPU
77202-H	GEN VII CHEVY BB PRO RAM RECTANGLE PORT 1000CFM
77202-I	GEN VII CHEVY BB PRO RAM OVAL PORT 1000CFM
77202-J	GEN VII CHEVY BB PRO RAM OVAL PORT 1200CFM
77202-K	GEN VII CHEVY BB PRO RAM RECTANGLE PORT 1200CFM

Plug and Play Systems

--Pre-calibrated systems for specific crate engines

77350P	P&P 350 FOR CRATE ENGINES
77350PS	P&P 350 W/DUAL SYNC
77350PW	P&P 350 W/WIDE BAND O2
77350PWS	P&P 350 W/DUAL SYNC & WIDE BAND O2
77454	P&P 454 OVAL PORT
77454R	P&P 454 RECTANGLE PORT CRATE
77454RS	P&P 454 RECTANGLE PORT W/DUAL SYNC
77454RW	P&P 454 RECTANGLE PORT W/WIDE BAND O2
77454RWS	P&P 454 RECTANGLE PORT W/DUAL SYNC & WIDE BAND O2
77454S	P&P 454 OVAL PORT W/ DUAL SYNC
77454W	P&P 454 OVAL PORT & WIDE BAND O2
77454WS	P&P 454 OVAL PORT DUAL SYNC & WIDE BAND O2
77502	P&P 502 OVAL PORT
77502R	P&P 502 RECTANGLE PORT
77502RS	P&P 502 RECTANGLE PORT W/DUAL SYNC
77502RW	P&P 502 RECTANGLE PORT W/WIDE BAND O2
77502RWS	P&P 502 RECTANGLE PORT W/DUAL SYNC & WIDE BAND O2
77502S	P&P 502 OVAL PORT W/DUAL SYNC
77502W	P&P 502 OVAL PORT W/WIDE BAND O2
77502WS	P&P 502 OVAL PORT W/DUAL SYNC & WIDE BAND O2

GEN VII Accessories and Harnesses

77063	GEN VII WIDE BAND LINEAR (UEGO) O2 KIT
77065	GEN VII REPLACEMENT WIDE BAND O2 SENSOR (SENSOR ONLY)
77101	DUAL SYNC IGNITION ADAPTER HARNESS (Req.for D/Sync Distributors)
77170	GEN VII F-BODY CONVERSION KIT
77171	GEN VII FAN CONTROL KIT
77172	GEN VII TORQUE CONVERTOR KIT
77173	GEN VII KNOCK CONTROL HARNESS KIT
77174	GEN VII SBC KNOCK CONTROL KIT (INCL.MODULE, SENSOR)
77175	GEN VII BBC KNOCK CONTROL KIT (INCL.MODULE, SENSOR)
77176	GEN VII A/C CLUTCH CONTROL HARNESS
77177	GEN VII MALFUNCTION INDICATOR LAMP HARNESS
77178	GEN VII FUEL-ONLY SIGNAL CONDITIONER
77253	GEN VII SINGLE STAGE NOS HARNESS
77650	GEN VII LT1 TPS ADAPTOR
77651	GEN VII LT1 IAC ADAPTOR
77652	GEN VII LT1 IGNITION ADAPTOR (95-92)

77653	GEN VII LT1 IGNITION ADAPTOR (97-96)
77656	GEN VII LARGE CAP HEI IGNITION ADAPTOR
77659	GEN VII BUICK GN IGNITION ADAPTOR
77660	GEN VII FORD TFI IGNITION ADAPTOR
77661	GEN VII FORD TPS ADAPTOR
77678	GEN VII 4 CYLINDER UNIVERSAL MAIN HARNESS
77679	GEN VII 4 CYLINDER UNIVERSAL INJECTOR HARNESS
77680	GEN VII CHEVY MAIN HARNESS
77681	GEN VII CHEVY INJECTOR HARNESS
77685	GEN VII TBI INJECTOR HARNESS
77686	GEN VII FORD 5.0 MAIN HARNESS
77687	GEN VII FORD 5.0 INJECTOR HARNESS
77688	GEN VII UNIVERSAL IGNITION ADAPTOR
77693	GEN VII BUICK GN 6 CYLINDER INJECTOR HARNESS
77697	GEN VII MULTI STAGE NOS HARNESS
77761	GEN VII 4 WIRE (HEGO) OXYGEN SENSOR (SENSOR ONLY)

Fuel Injectors

150114	PERF FUEL INJECTOR 14lb each
150115	PERF FUEL INJECTOR 15lb each
150117	PERF FUEL INJECTOR 17lb each
150119	PERF FUEL INJECTOR 19lb each
150121	PERF FUEL INJECTOR 21lb each
150123	PERF FUEL INJECTOR 23lb each
150124	PERF FUEL INJECTOR 24lb each
150126	PERF FUEL INJECTOR 26lb each
150130	PERF FUEL INJECTOR 30lb each
150132	PERF FUEL INJECTOR 32lb each
150136	PERF FUEL INJECTOR 36lb each
150140	PERF FUEL INJECTOR 40lb each
150144	PERF FUEL INJECTOR 44lb each
150148	PERF FUEL INJECTOR 48lb each
150414	PERF FUEL INJECTORS 14lb 4-pak
150415	PERF FUEL INJECTORS 15lb 4-pak
150417	PERF FUEL INJECTORS 17lb 4-pak
150614	PERF FUEL INJECTORS 14lb 6-pak
150615	PERF FUEL INJECTORS 15lb 6-pak
150617	PERF FUEL INJECTORS 17lb 6-pak
150619	PERF FUEL INJECTORS 19lb 6-pak
150621	PERF FUEL INJECTORS 21lb 6-pak
150623	PERF FUEL INJECTORS 23lb 6-pak
150624	PERF FUEL INJECTORS 24lb 6-pak
150626	PERF FUEL INJECTORS 26lb 6-pak
150630	PERF FUEL INJECTORS 30lb 6-pak

150632	PERF FUEL INJECTORS 32lb 6-pak
150636	PERF FUEL INJECTORS 36lb 6-pak
150640	PERF FUEL INJECTORS 40lb 6-pak
150644	PERF FUEL INJECTORS 44lb 6-pak
150648	PERF FUEL INJECTORS 48lb 6-pak
150814	PERF FUEL INJECTORS 14lb 8-pak
150815	PERF FUEL INJECTORS 15lb 8-pak
150817	PERF FUEL INJECTORS 17lb 8-pak
150819	PERF FUEL INJECTORS 19lb 8-pak
150821	PERF FUEL INJECTORS 21lb 8-pak
150823	PERF FUEL INJECTORS 23lb 8-pak
150824	PERF FUEL INJECTORS 24lb 8-pak
150826	PERF FUEL INJECTORS 26lb 8-pak
150830	PERF FUEL INJECTORS 30lb 8-pak
150832	PERF FUEL INJECTORS 32lb 8-pak
150836	PERF FUEL INJECTORS 36lb 8-pak
150840	PERF FUEL INJECTORS 40lb 8-pak
150844	PERF FUEL INJECTORS 44lb 8-pak
150848	PERF FUEL INJECTORS 48lb 8-pak
151195	HONDA PLUS INJ LOW IMP 195CC/M
151255	HONDA PLUS INJ LOW IMP 255CC/M
151370	HONDA PLUS INJ LOW IMP 370CC/M
152255	HONDA PLUS INJ HIGH IMP 255CC/M
153195	HONDA PLUS INJ HIGH IMP 195CC/M
153255	HONDA PLUS INJ HIGH IMP 255CC/M
153260	HONDA PLUS INJ HIGH IMP 260CC/M
153310	HONDA PLUS INJ HIGH IMP 310CC/M
154260	HONDA PLUS INJ HIGH IMP 260CC/M

Low Impedance Injectors

74612	INJECTOR 55#/HR (1-EACH)
74616	INJECTOR 72#/HR (1-EACH)
74607	INJECTOR 83#/HR (1-EACH)
74160	INJECTOR 160#/HR (1-EACH)

Accel/DFI Dual Sync Distributors

--Crank and Cam Signal allows for sequential operation of a Gen.7 system

77100	DUAL SYNC DISTRIBUTOR CHEVY SMALL CAP
77190	DUAL SYNC DISTRIBUTOR CHEVY LARGE CAP
77100-T	DUAL SYNC DISTRIBUTOR CHEVY SMALL CAP TALL DECK
77190-T	DUAL SYNC DISTRIBUTOR CHEVY LARGE CAP TALL DECK
77110	DUAL SYNC DISTRIBUTOR CORVETTE W/TACH DRIVE SMALL CAP
77151	DUAL SYNC DISTRIBUTOR CHEVY 4.3L V6 SMALL CAP
77159	DUAL SYNC DISTRIBUTOR CHEVY 4.3L V6 LARGE CAP

77201	DUAL SYNC DISTRIBUTOR FORD SB SMALL CAP
77291	DUAL SYNC DISTRIBUTOR FORD SB LARGE CAP
77207	DUAL SYNC DISTRIBUTOR FORD 351 WINDSOR SMALL CAP
77297	DUAL SYNC DISTRIBUTOR FORD 351 WINDSOR LARGE CAP
77204	DUAL SYNC DISTRIBUTOR FORD BB (351C-429-460) SMALL CAP
77294	DUAL SYNC DISTRIBUTOR FORD BB (351C-429-460) LARGE CAP
77313	DUAL SYNC DISTRIBUTOR HON DA 1.6L-1.8L
77301	DUAL SYNC DISTRIBUTOR BUICK (215CI) V8
77441	DUAL SYNC DISTRIBUTOR BUICK (400-430-455) SMALL CAP
77401	DUAL SYNC DISTRIBUTOR OLDSMOBILE SMALL CAP
77491	DUAL SYNC DISTRIBUTOR OLDSMOBILE LARGE CAP
77701	DUAL SYNC DISTRIBUTOR CHRYSLER B (383) SMALL CAP
77707	DUAL SYNC DISTRIBUTOR CHRYSLER HEMI (392) SMALL CAP
77801	DUAL SYNC DISTRIBUTOR CHRYSLER R-B (440) SMALL CAP
77548	DUAL SYNC DISTRIBUTOR CADILLAC SMALL CAP
77580	DUAL SYNC DISTRIBUTOR PONTIAC SMALL CAP
77601	DUAL SYNC DISTRIBUTOR AMC SMALL CAP
77901	DUAL SYNC DISTRIBUTOR CHRYSLER "LA" (318-360) SMALL CAP
77911	DUAL SYNC DISTRIBUTOR PORSCHE 911 SMALL CAP
77101*	DUAL SYNC IGNITION ADAPTER HARNESS (Req.for D/Sync Distributors)

ACCEL/DFI Engine Management Components

--Gen 6 Accessory Kits

74070	VARIABLE INJECTOR CONTROLLER
74170	F-BODY CONVERSION KIT
74171	FAN CONTROL KIT
74172	TORQUE CONVERTER LOCK-UP KIT
74173	KNOCK CONTROL HARNESS
74174	KNOCK CONTROL KIT-SBC (INCL.MODULE, SENSOR)
74175	KNOCK CONTROL KIT-BBC (INCL.MODULE, SENSOR)
74253	SINGLE STAGE NOS HARNESS KIT

Camshafts

74211	SUPER RAM SBC HYDRAULIC ROLLER CAM
74216	SUPER RAM SBC HYDRAULIC ROLLER CAM
74219	SUPER RAM SBC HYDRAULIC ROLLER CAM
74220	SUPER RAM SBC HYDRAULIC ROLLER CAM

Fuel Pressure Regulators

74560	ADJUSTABLE REGULATOR, DFI RAIL MOUNT
74561	ADJUSTABLE REGULATOR, 86-93 5.0L MUSTANG
74562	ADJUSTABLE REGULATOR, 94-98 FORD 4.6L

74565	ADJUSTABLE REGULATOR, 92-96 CORVETTE (LT1)
74566	ADJUSTABLE REGULATOR, 94-97 LT1 (EXCEPT 'VETTE)
74725	FUEL PRESSURE GAUGE KIT-FORD EFI
74726	FUEL PRESSURE GAUGE KIT-SB CHEVY TPI
74745	FUEL PRESSURE GAUGE CHEVY LT1
74750	ADJUSTABLE PRESSURE REGULATOR CHEVY TPI
74751	NONADJUSTABLE PRESSURE REGULATOR RAIL MOUNT
74753	FORD ADJUSTABLE REGULATOR ASSEMBLY
74755	PRESSURE REGULATOR SPACER
74756	REGULATOR BLOCK
74758	ADJUSTABLE FUEL PRESSURE REGULATOR CHEVY LT1

Gen VI Wiring and Adapters

74680	CHEVY MAIN WIRE HARNESS
74681	CHEVY INJECTOR HARNESS
74684	TPS/MAP HARNESS
74686	FORD MAIN HARNESS
74687	FORD INJECTOR HARNESS
74688	I.P.U. (CRANK TRIGGER) HARNESS KIT
74689	INJECTOR CONVERTOR HARNESS
74692	FUEL/SPARK HARNESS ADAPTOR
74693	BUICK/GN INJECTOR HARNESS
74694	BUICK/GN MAIN WIRE HARNESS
74695	INJECTOR HARNESS (TUNNEL RAM)
74696	GN TPS/MAP HARNESS
74697	MULTISTAGE NOS HARNESS KIT
74730	TPI FUEL RAIL FITTING KIT
74731	JUMPER LINE KIT 3/8" & 5/16"
74731A	JUMPER LINE 3/8"
74731B	JUMPER LINE 5/16"
74737	FUEL RAIL VALVE
74738	FUEL RAIL VALVE CAP
74739	FUEL RAIL SPACER (SET OF 8)
74743	3/8 NPT/6AN FITTING
74743H	HIGH FLOW FITTING
74744	6AN-90 DEGREE FITTING
74746	3/8 - 1/4 ADAPTOR FITTING
74747	6AN/6AN TEE FITTING
74748A	3/8 - 6-AN FITTING
74748B	5/16 TO 6AN FITTING
74761	HEATED O-2 SENSOR
74762	MICRO RELAY AUTO
74763	TPS SWITCH
74764	NA MAP SENSOR (1 BAR)
74765	COOLANT TEMP. SENSOR

74766	IDLE SPEED CONTROL MOTOR
74769	IDLE SPEED CONTROL MOTOR HOUSING
74770	IDLE SPEED CONTROL MOTOR ADAPTOR
74771	THROTTLE POSITION SENSOR CONVERTOR
74773	AIR TEMP. SENSOR
74775	MICRO-RELAY-MARINE
74776	MAP SENSOR 0-2 BAR
74777	MAP SENSOR 3 BAR
74778	IAC FILTER
74778H	IAC HOUSING
74781	TPS (HARLEY)
74801	MANIFOLD CONVERSION KIT
74811	ELECTRICAL CONN. KIT (1 PIN)
74812	2 PIN CONNECTOR ASSEMBLY
74813	3 PIN CONNECTOR ASSEMBLY
74814	4 PIN CONNECTOR ASSEMBLY
74815	5 PIN CONNECTOR ASSEMBLY
74816	6 PIN CONNECTOR ASSEMBLY
74834	BB SUPER RAM FUEL PRESSURE REGULATOR FITTING
74836	VACUUM FITTING

Fuel Pumps and Fittings

74701	ELECTRIC FUEL PUMP- 400 HP, TBI, 45PSI
74702	ELECTRIC FUEL PUMP- 870 HP
74707	BRAIDED LINE, REAR
74708	BRAIDED LINE, FRONT
74710	FUEL PUMP MOUNTING BRACKET
74711	FUEL PUMP FITTING - TO -6AN
74711H	HIGH FLOW FUEL PUMP FITTING TO -8AN
74712	TPI FUEL RAIL FITTINGS
74720	FUEL FILTER
74721	FUEL FILTER FITTING KIT TO -6AN
74723	3/8 COMPRESSION FITTING

Individual Manifolds and Accessories

74202B	CHEVY BB SUPER RAM RECTANGLE PORT BASE
74202C	CHEVY BB SUPER RAM OVAL PORT BASE
74202D	CHEVY BB PRO RAM (SINGLE PLANE) RECTANGLE PORT
74202E	CHEVY BB PRO RAM (SINGLE PLANE) OVAL PORT
74302L	FORD SB PRO RAM LARGE RUNNER MANIFOLD
74302S	FORD SB PRO RAM SMALL RUNNER MANIFOLD
74139	CHEVY SB PRO RAM (SINGLE PLANE) MANIFOLD W/ RAILS
74140	CHEVY SB PRO RAM (SINGLE PLANE) MANIFOLD

74197	CHEVY SB SUPER RAM MANIFOLD BASE
74197L	CHEVY LT-1 SUPER RAM MANIFOLD BASE
74189E	TPI HIGH FLOW PLENUM (85-89)
74189L	TPI HIGH FLOW PLENUM (89-91)
74190G	GASKET KIT, (TUNNEL RAM TB/AIR)
74194	BB SUPER RAM BRACKET
74195	TPI HIGH FLOW RUNNERS (85-88)
74195G	HIGH FLOW RUNNER GASKET KIT
74196	PLENUM AND RUNNERS
74196F	F-BODY PLENUM AND RUNNERS
74196G	SB SUPER RAM GASKET KIT
74198	SUPER RAM BILLET PLENUM LID
74199	TPI HIGH FLOW RUNNERS (89-91)
74200	CHEVY SB SUPER RAM THROTTLE BRACKET
74202P	CHEVY BB SUPER RAM PLENUM
74203L	LARGE EGR BLOCK OFF PLATE
74203S	SMALL EGR BLOCK OFF PLATE
74882	90 DEGREE PLENUM ADAPTOR
74831	TPI GASKET KIT

Throttle Bodies and Accessories

74066	1200 CFM THROTTLE BODY PROGRESSIVE KIT
74067	1200 CFM THROTTLE BODY LINKAGE
74068	1200 CFM THROTTLE BODY PRIMARY ARM
74069	1200 CFM THROTTLE BODY SECONDARY ARM
74202PL	1200 CFM BILLET THROTTLE BODY
74202PM	1200 CFM BILLET THROTTLE BODY WITH IAC & TPS
74191	1000 CFM THROTTLE BODY
74191L	1000 CFM THROTTLE BODY LT1 LPE
74192	1000 CFM AIR FILTER ADAPTOR KIT
74193	1000 CFM ACCESSORY KIT
74190	1000 CFM THROTTLE BODY W/ADAPTER
74135B	T.B.I. Throttle Body w/Fuel Rails and w/o electronics
74832	GASKET FRONT, 1000 CFM TB
74833	GASKET REAR, 1000 CFM TB

Fuel Rails and Injector Parts

77306	FORD FUEL RAIL KIT 5.0L & 5.8L
74732C	INJECTOR NOZZLE CLIP/TUNNEL RAM
74734-1	FUEL RAIL 1' EXTRUDED
74734-2	FUEL RAIL 2' EXTRUDED
74734-3	FUEL RAIL 3' EXTRUDED
74734-4	FUEL RAIL 4' EXTRUDED

74734-5	FUEL RAIL 5' EXTRUDED
74734-6	FUEL RAIL 6' EXTRUDED
74740	INJECTOR BUSHINGS (SET OF 8)
74741	INJECTOR O-RING
74802	MULTIPOINT INJ. CONNECTOR KIT
74735	CHEVROLET SB PRO RAM FUEL RAIL LEFT
74736	CHEVROLET SB PRO RAM FUEL RAIL RIGHT
74704	CHEVROLET SB SUPER RAM FUEL RAIL ASSY
74820	COLD START PLUG KIT

Software and Programming Accessories

Gen 6	DOS Based Software for Gen 6 systems
74990L	VERSION 6 CALMAP SOFTWARE W/ 25 FT SERIAL CABLE
74990N	VERSION 6 CALMAP 6.32 SOFTWARE
74990S	VERSION 6 CALMAP SOFTWARE W/ 5 FT CABLE
74991	VERSION 6 CALMAP 25 FT CABLE ONLY
74997	VERSION 6 SERIAL ADAPTOR CABLE HARNESS

Gen 7	Windows Based Software for Gen 7 Systems
77990L	GEN 7 CALMAP SOFTWARE, STANDARD KEY W/ 25 FT CABLE
77990S	GEN 7 CALMAP SOFTWARE, STANDARD KEY W/ 5 FT CABLE
77991	GEN 7 25 FT CALMAP CABLE ONLY
77992S	GEN 7 CALMAP SOFTWARE, PRO KEY
77003	CALMAP GEN 7+ STANDARD KEY ONLY
77003P	CALMAP GEN 7+ PRO KEY ONLY
77003U	CALMAP GEN 7+ SOFTWARE, ECM FLASH UPGRADE & NO KEY
77003SU	CALMAP GEN 7+ SOFTWARE, ECM FLASH UPGRADE W/STD KEY
77003PU	CALMAP GEN 7+ SOFTWARE, ECM FLASH UPGRADE W/PRO KEY
77990	CALMAP 2002 GEN 7 SOFTWARE ON CD (SOFTWARE ONLY)
77993	LATEST VERSION CALMAP GEN 7 SOFTWARE ON CD (SOFTWARE ONLY)

ECM INSTALLATION INSTRUCTIONS

1.1 Introduction

Congratulations on your purchase of the Generation 7.0+ Accel/DFI Engine Management System, one of the most advanced systems on the market today. The new 7.0+ ECM offers enhanced control, extended versatility, and improved reliability over our previous units. Utilizing the all-new CalMap software, spark and fuel delivery can be precisely matched to engine requirements, unlocking lost horsepower. This manual is written to assist you with the installation of your new system. This installation should be performed by a qualified technician that has a thorough knowledge of automobile electrical and mechanical systems, such as an Accel Engine Management Installation Center (EMIC). Accel has numerous EMICs that can install your new system, calibrate your engine, and fabricate or modify your intake manifold if necessary. Call Mr. Gasket at 1 (888) 674-2753 for an EMIC location nearest you for more details.

1.1.1 Minimum Computer System Requirements

- Microsoft Windows 98 (Second Edition), 2000, XP or better operating systems.
- Intel Pentium II processor, 400 MHz or faster or equivalent. Pentium III Processor or higher recommended.
- 64 MB of RAM.
- Monitor Resolution of 800x600 pixels, 1024x768 recommended.
- One serial communication port, properly configured through your operating system.
- One parallel port or USB port for Standard or Pro DFI PowerKey access

1.1.2 DFI CalMap Keyboard Shortcuts

Function Keys valid from any screen:

- F1** Activates the CalMap Online Help subsystem.
- F2** Loads the Base Volumetric Efficiency vs. MAP/RPM table.
- F3** Loads the Base Ignition Advance vs. MAP/RPM table.
- F4** Loads the Target Air:Fuel Ratio vs. MAP/RPM table.
- F5** Loads the Data Logging subsystem with the preset 'Autolog' configuration.
- F6** Download a Global Calibration from the ECM and save it to a disk file.
- F7** Upload a Global Calibration file to the ECM from a disk file.
- F8** Clears all the Error Codes in the ECM.
- F9** Attempts to establish communication with the ECM.
- F10** Sends control data to ECM from various configuration/parameter editing screens.
- F11** Loads the Tau vs. MAP/ECT table.
- F12** Loads the Acceleration Threshold editor.

ESC	Closes the current screen or window.
INSERT	Loads the last screen that was opened.
CTRL-F1	Displays CalMap online drawings and wiring diagrams.
CTRL-B	Loads the Boost Builder configuration screen.
CTRL-C	Loads the ECM Control configuration screen.
CTRL-D	Loads the Input Diagnostics screen.
CTRL-E	Loads the ECM Active Error Code Acknowledge screen.
CTRL-F	Loads the Data Logging Fuel Analysis Subsystem
CTRL-G	Loads the Data Logging Analysis subsystem.
CTRL-I	Loads the Idle configuration screen.
CTRL-L	Loads the Data Logging subsystem with the currently loaded configuration.
X	Multiplies highlighted cells by a user-defined value on table editing screens.
CTRL-N	Loads the ECM Sensor Measurement configuration screen.
CTRL-R	Loads the Data Logging Replay subsystem.
CTRL-S	Loads the ECM System Configuration Screen.
CTRL-V	Loads the Engine Parameter Monitor Screen.
CTRL-X	Exits the CalMap Engine Calibration Environment.
ALT-F	Begins navigation in the File menu.
ALT-U	Begins navigation in the Fuel menu.
ALT-I	Begins navigation in the Ignition menu.
ALT-D	Begins navigation in the Idle menu.
ALT-N	Begins navigation in the Nitrous menu.
ALT-L	Begins navigation in the Data Logging menu.
ALT-C	Begins navigation in the Configuration menu.
ALT-G	Begins navigation in the Diagnostics menu.
ALT-H	Begins navigation in the Help menu.

Configuration Screens:

TAB	Moves control to the next editable field on the screen.
Shift-TAB	Moves control to the previous editable field on the screen.
F10	Sends data to the ECM from the Active Edit Control on the screen.
Up/Dn	Arrows Changes the value of numeric controls. It does not send data to the ECM.
ENTER	Activates some controls such as switches, but does not send data to the ECM.

1.1.3 Electronic Access to Drawings and Schematics

Various drawings, wiring diagrams, and schematics are available electronically, and are accessible by pressing the CTRL and F1 keys from anywhere within the CalMap calibration environment, whether or not you are connected to an ECM. The online help system is available by pressing the F1 key.

1.2 Kit Contents

Description / Part Number

Generation 7.0+ Electronic Control Module (ECM)
Main Wiring Harness (MWH)
Injector Wire Harness (IWH)
Manifold Absolute Pressure (MAP) sensor (1 BAR)
Heated Oxygen Sensor (HEGO) 4 Wire
Coolant Temperature Sensor (CTS)
Intake Air Temperature Sensor (IAT)
Manifold Surface Temperature Sensor (MST)
Ignition Harness Adapter (IADP)
CalMap Software package with 5ft. communication cable
Ford kits also include the TPS & IAC motor, housing & adapter

Note: If you are missing any item, please contact your dealer immediately.

1.3 Required Tools

These are the tools that you will need to properly install your Accel/DFI engine management system:

Terminal crimping tool or long nose pliers
Wire stripping tool
Adjustable Crescent Wrench
Electric Drill (optional*)
Green Lee Punch (optional*)
#2 standard screwdriver
½" nut driver or socket equivalent
Solder and Soldering Iron (recommended)

(*) - Needed only when mounting the ECU in the passenger compartment)

1.4 Installation

These installation instructions are general recommendations intended as a basic starting reference point. The statistics and information shown below will vary with application. Consult your dealer for further details on your application.

1.4.1 Manifold Setup

1.4.1.1 Obtaining your manifold

From the ultra high performance, single plane, Pro-Ram manifold, to the torque monster, tuned-port, Street-Ram manifold. Accel has a wide variety of fuel injection manifolds available for your big block and small block Chevrolet and small block Ford. For the applications that would not be satisfied by our proven manifold designs, Accel has the hardware necessary to modify a non-EFI style intake for multi-port injection. Contact a dealer, or reference our catalog for part numbers. Accel/DFI also has Engine Management Installation Centers (EMIC's) that can not only install and tune your system, but also can also fabricate or modify an intake for you as well. For an EMIC nearest you, please call 1 (888) 674-2753.

1.4.1.2 Setting up your manifold

Prior to installing your manifold, make sure that gasket surfaces are clean. Accel recommends using a 180* thermostat. Place your thermostat and gasket on your manifold, put your thermostat housing on the manifold, and bolt it into place. If you are using a Street-Ram, Super-Ram or a stock TPI manifold, you will have to place the injectors into the fuel rail and bolt them on to your manifold before you bolt the runners and install the injector harness. When installing the fuel injectors, be careful not to cut the O-rings. A small amount of oil on each O-ring will aid in the assembly. If you are using a factory 1985-1989 plenum, you will need to plug off the Cold Start Injector port, use an Accel part number 74820.

If you are using old or used parts, prior to bolting the throttle body to the plenum, we recommend cleaning the throttle blade, bore, and IAC valve seat area. A significant amount of gum can accumulate in these areas which could effect the idle characteristics of an engine, and create calibration issues when tuning.

1.4.2 Vacuum Plumbing Connections

1. A vacuum line must be attached between the fuel pressure regulator and the side of the intake plenum (full manifold vacuum). Sometimes on four-barrel throttle bodies, this source is located on the bottom part of the throttle body. Do not splice into this vacuum line, this can promote an erratic vacuum signal.
2. Use a 7/16" diameter hose to connect the oil breather on the valve cover to the right side of the throttle body, if so equipped. If not, plug the corresponding port off on the throttle body.
3. Fuel only control setups use a 5/32" diameter vacuum line from the bottom of the throttle body to the vacuum advance canister on the distributor. This is a ported vacuum source, and should be used with non-computer-controlled distributors, or fuel only control

setups.

4. Connect the PCV valve to an intake vacuum source using a 3/8" hose. If you are not using a PCV valve, block off the vacuum source.

5. Using a 3/8" or larger diameter vacuum line connect the brake booster unit to the plenum.

6. Next, mount the MAP sensor on the firewall away from any heat or RFI source, such as a distributor, ignition wires, or ignition coil. Make sure the map sensor is above the level of the plenum to ensure any condensation will not collect in the line and harm the sensor. Connect the MAP sensor to the intake plenum (full manifold vacuum) with a vacuum hose. Always install the MAP port source at least 1" away from any intake port, preferably on the side of the plenum. Never use the intake floor area on a single or dual plane manifold for a MAP port source. The MAP sensor is extremely sensitive, and will pick up individual port intake pulses, making tuning very difficult. Also DO NOT splice into this line, inaccurate sensor readings could result.

If you have an installation on a boosted application, such as a turbo or supercharger, use tie wraps to secure all vacuum lines. Severe engine damage could occur if, for example, the vacuum line to the fuel regulator were to blow off under pressure. The regulator would no longer maintain a static pressure referenced to manifold pressure, therefore, the engine would lean out as boost in the manifold increases.

1.4.3 Fuel Pump Mounting, Wiring, and Plumbing

1.4.3.1 General

There are 2 high-pressure fuel pumps available from the ACCEL division of Mr. Gasket. Both can be mounted in the gas tank, or externally on the frame rail. An ACCEL part number 74701 will support ~400 horsepower at 45 PSI in non-boosted or normally aspirated application, and approximately ~300 horsepower at 45 PSI in a boosted, or turbocharged environment. An ACCEL part number 74702 will support ~800 HP at 45 PSI, non-boosted, and approximately ~675 HP in a boosted application. You can also use a part number 74710 fuel pump, mounting bracket if your ACCEL 74702 pump is mounted outside the tank. Regardless of the fuel pump used, be sure to mount your fuel pump near the gas tank, and at a point below tank level if possible. Fuel pumps and plumbing should be protected and shielded from exhaust and engine heat, and road damage. For in-tank applications, you must use a filter or sock on the suction side of the pump, otherwise debris from the tank will seize the vane assembly causing complete pump failure. This type of pump failure is not covered under warranty.

1.4.3.2 Fuel Pump Wiring

Locate the fuel pump wire in the main wiring harness. It is a pink wire with black tracer that

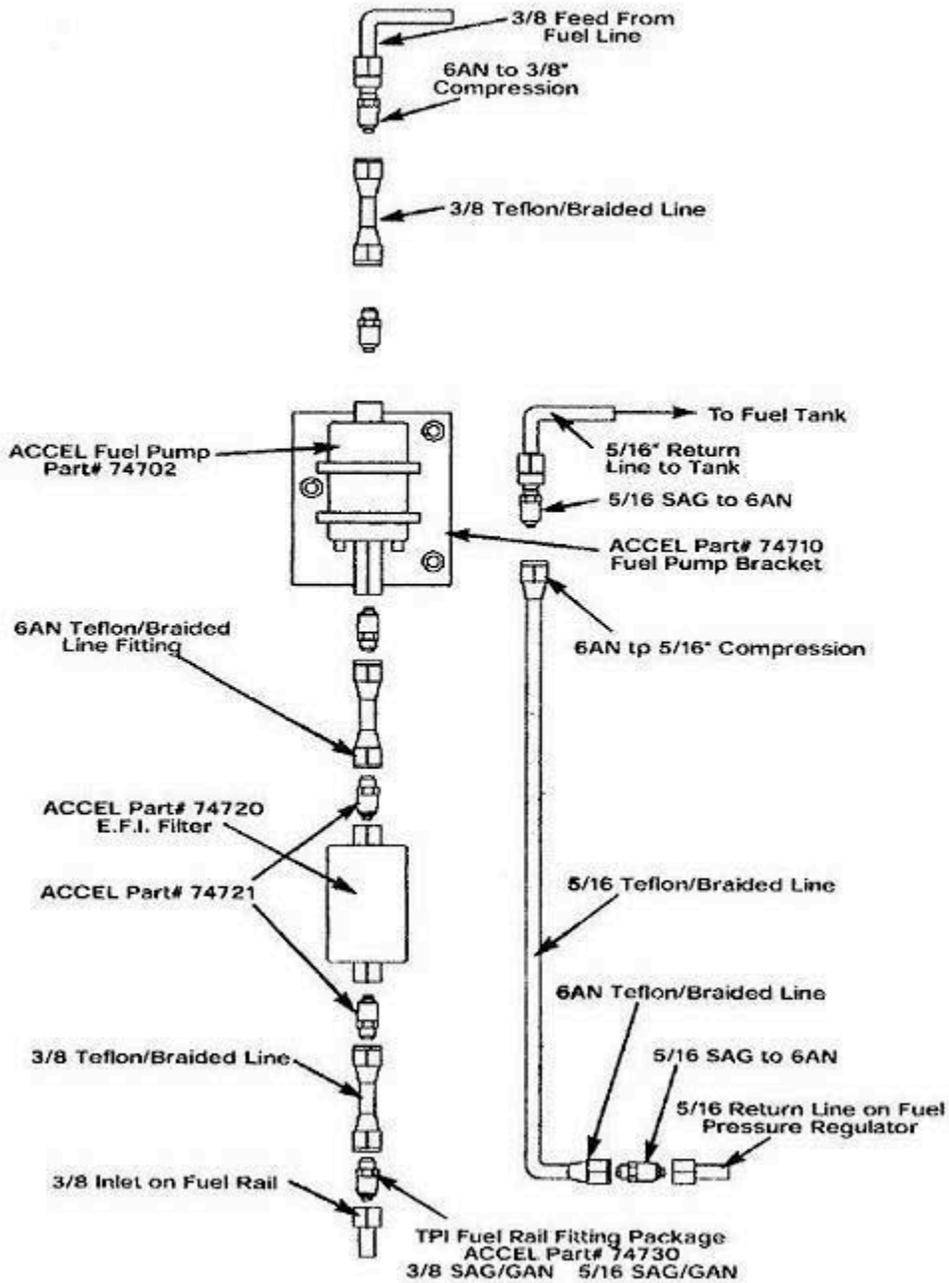
runs out of Relay #2, pin 30. Connect this wire to the fuel pump (+) terminal. The ECM will control the relay that supplies the 12 volts necessary to operate the pump. The pump will draw roughly 4 to 10 amps, or more, depending on pump size and fuel system pressures. If you need to lengthen the wire between the pump and the relay, use 14 gauge wire. Solder and shrink-wrap all your connections. If you are using an ultra high performance pump, replace the 14-gauge wire supplied, with a 10 gauge GXL or TXL rated wire. This wire, depending on length, is rated to carry up to 30 amps if your application merits. Next, ground the fuel pump negative (-) terminal to a clean, paint-free point on the frame rail, or run the proper gauge wire to the battery negative. Make sure the wiring between the fuel pump and the engine compartment does not hang below the vehicle, interfere with rotating parts, or become exposed to excess heat.

1.4.3.3 Mechanical Pump Removal

If your engine had a carburetor, be sure to remove your mechanical fuel pump, the fuel pump-actuating rod, and cover the opening with a block off plate.

1.4.3.4 Fuel System Installation

Typical Fuel System Layout



1.4.3.4.1 Fuel Filter Mounting

Two filters should be used when installing your high-pressure fuel delivery system. First, install a high pressure, 10-micron, paper filter between the high-pressure discharge of your fuel pump and the fuel rails. ACCEL offers a #74720, 10 micron, filter that utilizes –6 AN fittings, #74721. For maximum flow applications, –8AN fittings are available, #74721-H. Second, on the suction side of the pump, install a 40-micron low restriction filter. For in-tank applications, a fuel sock can be installed on the inlet of the pump. If you do not use a filter or sock on the suction side of the pump, debris from the tank will seize the vane assembly causing pump failure. This type of pump failure is not covered under warranty. See the Typical Fuel System Layout diagram for details.

1.4.3.5 Routing Fuel Hose

Unlike your low-pressure carburetor (7-PSI) fuel system, your ACCEL high-pressure (45PSI) fuel injection system requires high-pressure fuel hose. Typically, use any fuel hose with a continuous operating pressure of 150 PSI and burst strength rating, of at least 330 PSI. Hose diameter should be at least 3/8" feed, and 5/16" return for street systems, or larger for performance race systems. For maximum flow applications, limit the use of 90° fittings. If possible, use bent tube or 45° fittings in place of right angle fittings. Also avoid any sharp bends in your fuel line that could cause premature failure or leaks. As a general rule, always match the proper hose diameter to the fuel pump output. When using (2) high-pressure pumps, mount pumps as close to the fuel tank, and low on the frame rail as possible. Be careful not to interfere with any suspension components, or exhaust components in the process. See Typical Fuel System Layout diagram for details.

1.4.3.6 Dual Tanks

For dual tank applications, such as trucks or RV's, a primer pump must be installed in each fuel tank. The primer pump will feed a multi-port switching valve which draws and returns fuel to the tank that is selected. The implementation of the switching valve is important to ensure the feed and return lines operate on the same gas tank. Failure to use this method on dual tank applications will cause the tank to overflow or run dry. These primer pumps are commercially available through your factory dealer for most light and heavy trucks with dual tanks.

1.4.3.7 Sending Unit Modifications

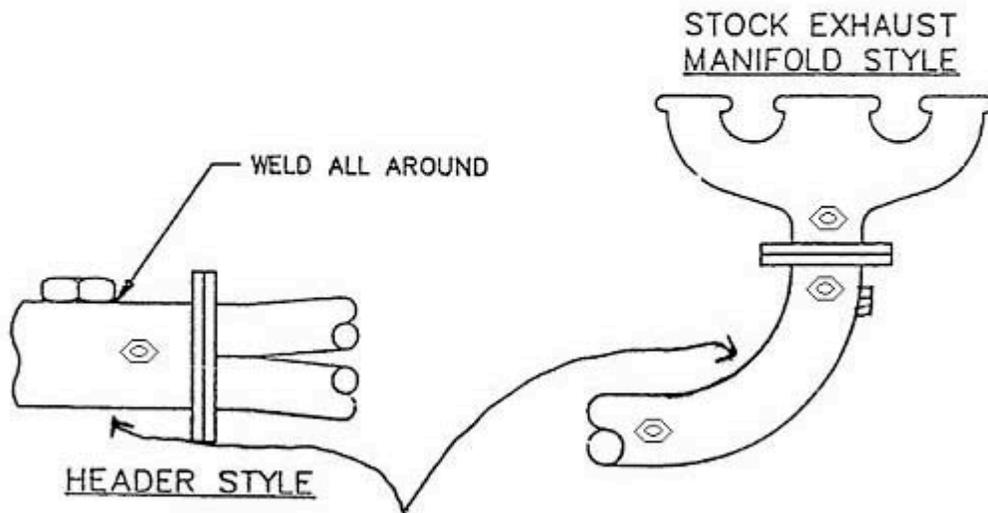
To install a return line in your tank, remove the sender assembly from the fuel tank and drill a 5/16" hole through the top of the flange. Be sure to give yourself enough room to weld the tube into place. Use an ACCEL/DFI jumper kit, #74731, to facilitate the installation. Position the 5/16" return tube roughly 2" off the floor of the tank. Before welding the tube, make sure the tube does not interfere with the sending unit float. Secure the tube to the sending unit cap by welding or brazing with low heat, so that flange warpage and electrical wire abrasion does not occur. Always check for minor cracks or leaks in the welding area.

1.4.3.8 Return Fuel Line Installation

If your vehicle was originally equipped with a carburetor than you must run a return fuel line to the tank. The fuel regulator discharge on all Accel kits utilizes -6AN fittings, so Accel recommends using a -6AN line or equivalent when installing the return line. Even though most vehicles came equipped with a "vent" line as part of the evaporative containment system. Accel strongly recommends that you do not use the vent line as a return line. These lines usually have a restrictor orifice built into the line near the tank. The restrictor orifice will cause excessive backpressure in the fuel line making tuning very difficult. Always make sure the gas tank is vented in an environmentally safe manner as per service manual requirements for you make and model vehicle.

1.4.4 Mounting the Exhaust Sensor

Typical Oxygen Sensor Mounting



Do not mount underneath, or on short side radius!

The Accel/DFI system uses a four wire Heated oxygen sensor (HEGO) to monitor exhaust oxygen levels. This sensor and a M18x1.5 hex nut or bung is part of your kit.

Prior to mounting the O2 nut, drill a 5/8" diameter hole perpendicular to the exhaust pipe or header collector, then weld the O2 nut on the pipe. In turbocharged applications, mount the O2 nut roughly 8" from the turbo exhaust discharge if possible. When using large diameter exhaust tubing, such as 3" or larger, make sure the O2 is mounted within 12" of an exhaust collector. Never mount the O2 on an inside radius of a 45* or 90* elbow. At low engine speeds, the exhaust gas will travel along the outside radius of the elbow giving the O2 sensor erratic or improper readings, making calibration efforts difficult at best. Never mount the O2 sensor on the underside of the pipe as condensation will collect on the sensor causing sensor failure.

1.4.5 Installing your distributor, crank sensor, or cam sensor

1.4.5.1 Ignition systems with Computer Controlled Timing

1.4.5.1.1 Selection

There are numerous types of distributors and trigger wheels available on the market today. The Accel ECM can control timing using these types of distributors and crank triggers:

- GM (HEI), High Energy Ignition, coil in cap (Large Cap)
- GM (HEI), High Energy Ignition, with separate coil (i.e. F-Body, Small Cap)
- Universal (IPU), Inductive Pickup, or Magnetic Pickup distributor
- Universal (IPU), dual sync with cam sensor
- Inductive Pickup Cam Sensor
- Universal Hall Effect distributor
- Universal Hall Effect, with cam sensor
- Hall Effect Cam Sensor
- GM (LT1) optical spark distributor
- Ford (TFI), Thick Film Ignition distributor
- Honda (VTEC), dual sync, IPU distributor
- Buick V6, DIS, coil pack ('87 and earlier)
- Universal Flying Magnet or Lug Crank Triggers with non-magnetic, magnetic Inductive Pickup sensors, or Hall Effect sensors
- Hall Effect Crank Sensors

Note: All of the above sensor triggers must have one tooth per spark event. For example, you would use a symmetric 4-tooth crank trigger wheel or an 8-tooth distributor reluctor on an 8 cylinder. A symmetric 3 tooth crank trigger wheel or a 6-tooth distributor reluctor on a 6 cylinder. And a symmetric 2- tooth crank trigger wheel or a 4- tooth distributor reluctor on a 4-cylinder engine. The ACCEL/DFI ECM does not recognize 24- tooth late model Chevrolet wheels. Call the ACCEL Digital Fuel Injection Tech Line for more information: (248) 380-2780

All the distributors listed above should have no mechanical advance mechanism or the

mechanical advance locked out. Always select a distributor that does not incorporate a vacuum advance canister. Many different engine combinations are possible using these distributor types. For example, to have complete ignition control on a Chevrolet motor with a points distributor, you would need to replace the points distributor with an Dual Sync, HEI, Hall effect or IPU distributor (available from Accel or Mallory). Then install a spark enhancer box, such as an Accel 300+, Mallory Hyfire, or MSD. This scenario also holds true if you own an Oldsmobile, Pontiac, Ford, Chrysler, or any application, where a distributor from the list, is available. All of the above distributor combinations will operate the fuel injectors in TBI (Throttle Body Injection), Staggered Batch SDF (bank to bank), and Staged Batch SDF modes. However, a Dual Sync distributor, or a combination crank trigger with a modified IPU, Hall effect distributor, or cam sensor is needed for sequential fuel operation. If a cam sync is not used while the ECM is in sequential operation, the injectors will fire according to the order set in CalMap, Configuration, Injector Firing Order table. Every time the engine starts, a new or random cylinder position will begin this firing order. Accel recommends that you set your Injection Type to a Staggered batch mode of operation, if you do not have a cam sync signal. Serious driveability issues will result that cannot be tuned out with the use of CalMap. (Note: The Buick DIS coil pack has an integral sync output for sequential operation. No external cam inputs are required). Please, consult your dealer for applications not listed above.

1.4.5.1.2 Installation

Chose an ignition type that best fits your application.

Chevrolet HEI distributors, Non-Sequential fuel mode



GM High Energy Ignition (HEI) Small Cap



GM High Energy Ignition (HEI) Large Cap

Set the ignition timing at the engine harmonic balancer timing mark to approximately 0* BTDC on #1 cylinder. Consult your shop manual for more information on this procedure. Align the magnetic pickup to the nearest reluctor. Next, set the ignition timing at the engine harmonic balancer timing mark to approximately 25*-30* BTDC on #1 cylinder.

The distributor rotor is pointing at the #1 cylinder terminal tower. Install the spark plug wires on the distributor starting with #1 wire in this location. Snug down the distributor lockdown bolt. This is your macro adjustment. The micro or fine adjustment occurs upon engine startup.

Next, connect the distributor to the 8-pin ignition connector on the main wiring harness; use the HEI large cap or small cap adapter supplied with your kit. See the Online Drawings and Schematics provided within the CalMap Software Environment (CTRL-F1) for details.

Chevrolet LT1, Non-Sequential* fuel mode

There are no external adjustments on the LT1 optical spark system. All clocking positions are preset at the factory. Connect the ignition interface adapter harness to the 8-pin connector on the main wiring harness. See the Online Drawings and Schematics provided within the CalMap Software Environment (CTRL-F1) for details.

* **Note:** This application can run in sequential mode if using a special adapter harness/box available through specific dealers. Call the Accel Digital Fuel Injection Tech Line for more details: (248) 380-2780.

Ford Thick Film Distributor, Non-Sequential fuel mode



Set the ignition timing at the engine harmonic balancer timing mark to approximately 0° BTDC on #1 cylinder. Consult your shop manual for more information on this procedure. Align the falling edge of the reluctor wheel to the pickup. Next, set the ignition timing at the engine harmonic balancer timing mark to approximately 25°-30° BTDC on #1 cylinder. The distributor rotor is pointing at the #1 cylinder terminal tower. Install the spark plug wires on the distributor starting with #1 wire in this location. Snug down the distributor lockdown bolt. This is your macro adjustment. The micro or fine adjustment occurs upon engine startup.

Next, connect the distributor to the 8-pin ignition connector on the main wiring harness using the Ford adapter supplied with your kit. Connect the single pin connector to the coil negative terminal or to the Points trigger lead of an enhancer box. See the Online Drawings and Schematics provided within the CalMap Software Environment (CTRL-F1) for details.

Buick GN, DIS, Coil Pack, Sequential fuel mode

There are no external crank sensor adjustments on the Buick GN, DIS system. However, the Cam sensor must be oriented correctly so that the spark module will provide the proper signal to the Accel ECM. Using a Voltmeter, place the meter leads across the sensor jumper wire and ground. Adjust the timing mark on the balancer to 25° ATDC #1 cylinder. Rotate the cam sensor until the voltmeter reads 5 to 7 volts. Rotate the sensor

counterclockwise until the reading drops to 0 volts. Lock down your sensor. This is an OEM factory adjustment. For further details on setting this sensor, reference your shop manual. Connect the ignition interface adapter harness to the 8-pin connector on the main wiring harness. See the Online Drawings and Schematics provided within the CalMap Software Environment (CTRL-F1) for details.

Honda (VTEC) distributor, Sequential operation or Staggered Batch Fuel Mode

A Honda distributor has no adjustments for its position in the engine block. Set the ignition timing to approximately 10° BTDC on #1 cylinder. Install the distributor in the engine aligning the distributor rotor to the corresponding #1 spark plug wire, terminal tower. Tighten the distributor lockdown bolt. The macro adjustment occurs before engine startup. This is completed through the crank index offset table in CalMap. Next, connect the distributor to the 8-pin ignition connector on the main wiring harness using the ignition adapter supplied with your kit. Terminate the wires from the stock distributor connector to the following locations. Use the four-tooth trigger wheel for the Crankshaft position sensor. Locate the Orange w/Blue tracer wire, Crank (+) reference, on the distributor this goes to pin 'D' on the 8-pin ignition connector. The White w/Blue tracer wire, Crank (-) ground, on the distributor this goes to pin 'C' on the 8-pin ignition connector, Use the 16/24 tooth trigger wheel for the Camshaft position sensor. (To use this trigger as a Cam position sensor set the Engine 90° BTDC #1 cylinder, then mark the reluctor that is closest to the pickup and remove all other teeth). The Blue w/Green tracer wire Cam (+) reference, on the distributor this goes to pin 'F' on the 8-pin ignition connector, the Blue w/Yellow tracer wire, Cam (-) ground, on the distributor this goes to pin 'E' on the 8-pin ignition connector. See the Online Drawings and Schematics provided within the CalMap Software Environment (CTRL-F1) for details.

Note that an ignition enhancer box must be used with the Honda VTEC Distributor!

Inductive Pick-Up (IPU) or Hall Effect distributors, Non-Sequential mode



Set the ignition timing at the engine harmonic balancer timing mark to approximately 0° BTDC on #1 cylinder. Consult your shop manual for more information on this procedure. Align the magnetic pickup to the nearest reluctor. Next, set the ignition timing at the engine harmonic balancer timing mark to approximately 25°-30° BTDC on #1 cylinder. The distributor rotor is pointing at the #1 cylinder terminal tower. Install the spark plug wires on the distributor starting with #1 wire in this location.

Snug down the distributor lockdown bolt. This is your macro adjustment. The micro or fine adjustment occurs upon engine startup. Next, connect the distributor to the 8-pin ignition connector on the main wiring harness, using the IPU adapter supplied with your kit. Terminate the two wire leads from the distributor to these wires. The Crank (+) goes to pin 'D' on the 8-pin ignition connector, The Crank (-) goes to pin 'C' on the 8-pin ignition connector. See the Online Drawings and Schematics provided within the CalMap Software Environment (CTRL-F1) for details. Note that an ignition enhancer box must be used with this type of Distributor!



Accel/DFI Dual Sync Distributor Installation Instructions

1. Make a mark on the distributor housing to indicate the location of the wire for cylinder #1, and remove the cap from the distributor.
2. Rotate the engine to Top Dead Center of cylinder #1, and make a note of which direction the rotor is turns (either clockwise, or counter-clockwise). Verify that the rotor is now pointing at the sparkplug wire for cylinder #1.
3. If replacing another distributor, disconnect the distributor wires and remove the distributor from the engine.
4. Before installing the distributor, attach the Dual Sync Distributor adapter wire harness to the DFI Gen 7 main wire harness, ensuring that the ground leads are also connected to an appropriate grounding point on the engine. Be sure to connect the Dark Blue wire (Pin H of 8-Pin Ignition Connector) to your ignition enhancer box (if applicable). Note that an ignition enhancer box must be used with this Distributor!
5. Turn the ignition to the **Key-On, Engine-Off** position, and launch the DFI CalMap Engine Management Software program.

6. Select the “Online from ECM” data source, and go to the Engine Configuration screen by pressing the **CTRL-S** key combination, or selecting the **System** menu item from the **Configuration** menu.
7. From the **Injection Type** drop-down list, select **Sequential** for your fuel injection control strategy. Press the F10 key on your keyboard to send this change directly to the DFI Gen 7 Engine Control Module.
8. Change the **Crank Trigger Edge** switch to the **Falling** position. Press **F10** to send the data to the ECM.
9. Change the **Cam Trigger Edge** switch to **Falling** and press **F10**.
10. Change the **Output Trigger Edge** switch to **Rising**, and press **F10**.
11. Change the **Crank Signal Input Type** to **Hall Effect** and press **F10**.
12. Change the **Cam Signal Input Type** to **Hall Effect** and press **F10**.
13. Change the **Output Signal Type** to **Sink, Points**, and press **F10**.
14. Verify that the **Fuel Injector Firing Order** is set to the desired firing order, and press **F10**.
15. If no error messages were observed, exit the CalMap program using the **File->Exit** menu command, by pressing the **CTRL-X** key combination, or by clicking on the Gen 7 DFI icon on the lower right portion of the screen. If any error messages were present, repeat steps 5-14.
16. Position the Dual Sync Distributor so that you can see both the Red (Crank) and Blue (Cam) LEDs. Verify that the ignition is still in the **Key-On, Engine-Off** position.
17. Rotate the distributor in the same direction as noted earlier (either clockwise or counter-clockwise). Continue rotating until blue LED shuts off completely. This indicates the falling edge of the cam trigger position.
18. Continue to slowly rotate the distributor **until the Red LED shuts off**. Stop at this point. This indicates the falling edge of the crank trigger position. Your distributor is now set to Top Dead Center of cylinder #1.
19. While taking care not to rotate the distributor, install it on your engine. The oil pump drive shaft may have to be rotated somewhat to get the distributor seated properly.
20. Verify that neither of the cam or crank LEDs are lit. If this is not the case, repeat steps 14-17 until neither LED is lit, and the distributor is installed in the engine. Lock down

the distributor, and turn the ignition key to the **Off** position. The key must remain in the **Off** position for at least 30 seconds for the programming changes to be implemented by the ECM.

21. Rotate the engine backward to 25-35 degrees BTDC. Make a small mark on the outside of the distributor, adjacent to where the rotor is pointing.
22. Install the distributor cap, and make a second mark at the terminal closest to the first mark. This is the terminal for cylinder #1.
23. Remove the distributor cap, and adjust the rotor so it is pointed at the center of the cylinder #1 terminal, using the two small Philips-head screws.
24. Install the distributor cap and spark plug wires. Double check that the spark plug wires match the firing order previously set in the ECM.
25. Your Dual Sync Distributor is now correctly mounted, phased, and ready to run Sequential Fuel Injection.

Crank Trigger/ Distributor combinations, Sequential fuel mode

Set the ignition timing at the engine harmonic balancer timing mark to approximately 0* BTDC on #1 cylinder. Position the crank sensor directly over the falling edge of one of the crank trigger wheel teeth. If the bracket arrangement does not allow this, align the sensor as close as possible to the trigger tooth. This difference between the sensor and trigger wheel tooth in crank degrees should not exceed the total advance of the engine in crank degrees minus 6. The difference in crank position can be compensated through the crank index position table in CalMap. Next, obtain an Inductive Pickup or Hall Effect distributor. Remove all but one of the reluctors. Leaving the reductor closest to the rotor discharge point. Rotate the engine so that the timing mark is set to ~45* BTDC #1 on an eight cylinder, ~60* BTDC #1 on a six cylinder, or ~90* BTDC #1 on a four cylinder. Use a timing tape if necessary to gain an accurate reading. Tapes are available through your local Mr. Gasket Dealer. Install the distributor. Rotate the distributor, aligning the pickup over the reductor wheel. Tighten down the distributor lockdown bolt. Rotate the engine back to TDC #1 cylinder. The distributor rotor is now pointing to the corresponding #1 spark plug wire, terminal tower. Referencing your firing order, install your plug wires using this terminal as a starting position. Next, connect the distributor cam signal wires and the trigger wheel crank sensor wires to the 8-pin ignition connector on the main wiring harness, using the IPU adapter supplied with your kit. The Crank (+) goes to pin 'D' on the 8-pin ignition connector, The Crank (-) goes to pin 'C' on the 8-pin ignition connector. The Cam (+) wire goes to pin 'F' on the 8-Pin ignition connector. The Cam (-) wire goes to pin 'E' on the ignition connector. See the Online Drawings and Schematics provided within the CalMap Software Environment (CTRL-F1) for details. Note that an ignition enhancer box must be used with this type of Distributor!

Important:

If you have computer controlled ignition timing, or if you are using an enhancer box such as an ACCEL 300+, Mallory, or MSD, NEVER hook the crank reference (+) wire to the coil (-). This WILL result in Serious Damage to the ECM.

ACCEL has encountered problems with various ignition wires available on the market such as helically wound or solid core that have a very high (RFI) electrical noise emission. Even though the ECM utilizes the latest in noise suppression technology, Accel strongly urges the use of a good quality suppression wire such as an Accel Ferro core RFI Suppression wire. Further, some high-energy aftermarket ignitions produce electrical fields, which will interfere with the ECM's operation. Use of these units is strictly at the risk of the owner. Call ACCEL for ignition system compatibility.

Finally, verify that the system part number that you ordered is compatible with the ignition system on the vehicle. If not, reference the ignition chart (See CalMap Online Help) for further details. (Note: To change ignition input and output parameters, CalMap software is needed. Refer to the Tuning instructions for more details.)

1.4.5.2 Non-Computer Controlled Timing



Fuel-Only Type Distributor

1.4.5.2.1 Installation

Set the ignition timing at the engine harmonic balancer timing tab to 8° BTDC on #1 cylinder. Install the distributor, aligning the rotor to the corresponding #1 spark plug wire terminal tower. Snug down the distributor lockdown bolt.

Setting vacuum and mechanical advance

First, estimate a total timing value for your motor. The total timing value is the static or base advance added to the dynamic or mechanical advance. Most normally aspirated motors need about 30-38° of total timing at wide open throttle. Excessive total timing will result in major engine damage, consult with your engine builder for optimum timing numbers. Adjust the base or static advance to 10°-20° BTDC depending on your camshaft selection and compression ratio. Usually, a higher duration camshaft profile, and low compression ratio tend to require more timing lead, or more base advance. Next, set the mechanical advance. Rev the motor to at least 3500 RPM, verify timing. (Note: If you do not have an adjustable timing light, use timing tape over the harmonic balancer.

Mr. Gasket has the following timing tapes available:

- Chevrolet 6 3/4" Dia. 283-400 C. I. #1588

- Chevrolet 7" Dia. 1965-69, 396-427 C. I. and 1970, 400 C. I. small block #1589
- Chevrolet 8" Dia. 1970-73, 396-427-454 C. I. 1965-68 327 C. I. Hi-Perf. and 1970-73, 350 C. I. #1591
- Chevrolet 6" Dia. 1957-69, 283-302-307-327-350 C. I. #1592
- Ford 6 3/8" Dia. 289-302-351 C. I. #1594
- Ford 7" Dia. 390-427-428-429 C. I. #1595
- Mopar 7 1/4" Dia. All 383 through 440 C. I. #1593
- Mopar 7 1/4" Dia. 340 C. I. #1598
- Oldsmobile 6" Dia. 1968-77 350-400-403-455 C. I. #1596
- Pontiac 5 1/4" Dia. All 1968-73 #1597.

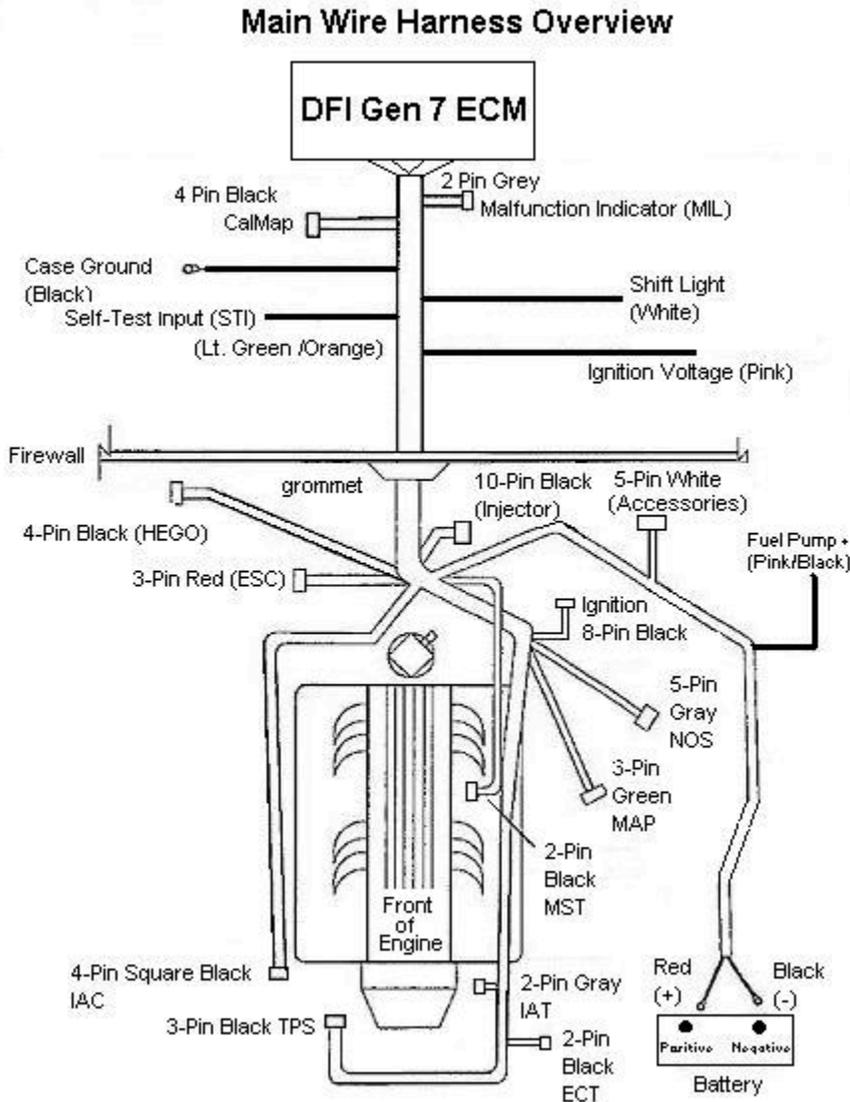
Next, adjust, the springs on the mechanical advance mechanism to obtain the proper total timing advance. Consult you distributor manufacturer for more details.

The vacuum advance can now be adjusted for optimum driveability. The vacuum canister can be modulated by the EGR port of the throttle body. For performance applications, adjust the vacuum advance to achieve the maximum amount of spark advance without engine knock or ping. Look for a max value of 40-50* BTDC advance under light load high vacuum conditions.

1.4.5.2.2 Distributor Wiring

In all non-computer controlled applications, the ignition system works independently of the engine control unit, so wire the distributor and coil per manufacturers recommendations. The only ignition signal needed by the ACCEL/DFI ECM is the engine rpm or tachometer output signal. Connect the Crank (+) wire, Pin 'D' on the 8-pin Ignition connector, to the coil negative (-) or If you are using an aftermarket enhancer box (i.e. Accel 300+, Mallory Hyfire, MSD), connect the crank reference (+) wire directly to the tachometer output lead of the enhancer box. DO NOT connect the ECM crank (+) wire to coil (-) terminal if using an enhancer box, extensive ECM damage will result. Tachometer signal output strength varies with ignition manufacturer depending on the enhancer box used. If you do not see a RPM signal in your CalMap, Instrument view mode while cranking, a tachometer amplifier should be used. Again, confer with your ignition manufacturer for availability.

1.4.6 Main wiring harness and ECM installation



1.4.6.1 Mounting Your DFI Gen 7 ECM

The ECM comes with four (4) 1/4" holes designed for a #6 sheetmetal screw. It is recommended to mount the ECM in a cool, dry place usually in the passenger side, kickpanel, in the dashboard behind the glove box, or under the passenger seat. If these areas are not convenient, mount the ECM under the hood. Even though the ECM utilizes a water-resistant enclosure, ACCEL/DFI recommends mounting the ECM away from any direct moisture contact. (i.e. from wheel well openings, or behind the grill). It is also important to mount the ECM away from any direct radiant heat source such as exhaust manifolds or headers. Failure to do so may result in a void warranty, as well as, damage to the ECM. NOTE: Accele recommends the use of a 1 5/8"

Holesaw (i.e. Green Lee punch) to cut holes in the firewall. This will accommodate the main wiring harness, when mounting the ECM inside the passenger compartment.

1.4.6.2 Wiring Harness Installation

There are various main wiring harness (MWH) combinations available for your ACCEL/ DFI system. From the list below, select the harness type that best fits your application. Also, choose your ignition from the following listing. See the Online Drawings and Schematics provided within the CalMap Software Environment (CTRL-F1) for details.

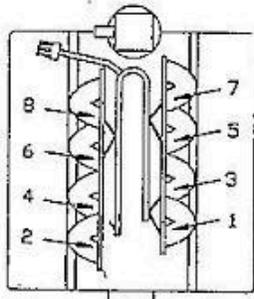
- Small and Big Block Chevrolet, (HEI) High Energy Ignition
- Small Block Chevrolet, (LT1), early and late model
- Small Block Ford, (TFI), Thick Film Ignition.
- Buick V6, (DIS), Distributorless Ignition System.
- Universal L4, N/A and blown engines.
- Universal V8, (IPU), distributor
- Universal V8, Crank Trigger (Flying Magnet and Hall Effect)
- Universal V4-6-8, Fuel Control ONLY

1.4.6.2.1 Fuel Injector Harness Installation

When using a StreetRam or SuperRam intake manifold, Accel advises that the injector harness be installed prior to mounting the plenum. In all fuel modes, whether you use sequential or batch fire, placement of the injector connector is critical. Each injector connector should plug into the corresponding cylinder it controls. Locate the cylinder tag on above each injector connector. Refer to the following diagram for details on placement within your engine.

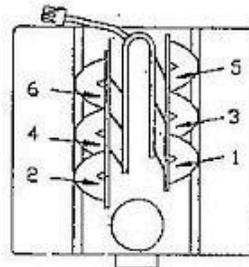
Typical Fuel Injector Placements

Chevrolet
1-8-4-3-6-5-7-2



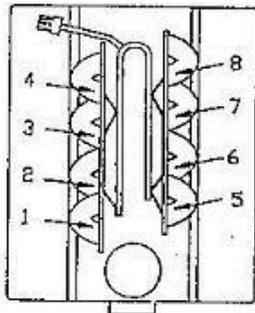
Front

Buick V-6
1-6-5-4-3-2



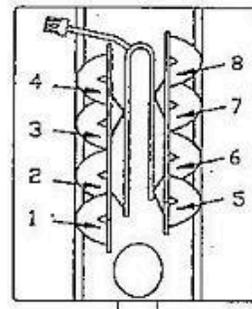
Front

Ford 302
1-5-4-2-6-3-7-8



Front

Ford 351W
1-3-7-2-6-5-4-8



Front

1.4.6.2.2 Main Wiring Harness Installation

The main wiring harness can be routed and connected as follows: When mounting the ECM in the passenger compartment. Drill two 1 5/8th-inch holes in the firewall using a hole saw, or Green Lee punches. Starting on the engine side of the firewall, route the two 30-pin ECM connectors through the hole in the firewall. Pull the harness through the firewall until the rubber grommets seats in the firewall. For all other under hood applications, start by attaching the two 30-pin connectors to the ECM. Using a _” nut driver, tighten the two connectors (P1&P2) securely to the ECM. Route each leg of the harness to the appropriate sensor. Make sure to connect the switched +12 volt wire (long pink wire), to a switched ignition accessory in the fuse box. The switched ignition accessory must maintain a constant ignition voltage while cranking, if it does not, the vehicle will not start. Some older vehicles (pre '75) do not have a constant (12V) switched ignition voltage supply while cranking. This can be verified with a test light or voltmeter. If your switched ignition voltage is not a constant 12V, ACCEL suggests that you run a jumper wire from the starter solenoid start circuit to your power input to the ECM. Next, connect the positive and negative terminals of the main wiring harness directly to the battery. Using the frame as a grounding plane is not recommended. Grounding loops have occurred using this method. ACCEL suggests that these connections be free of any paint, grease, or debris. If for any reason, any one of these wires need to be lengthened, make sure the wire is at least the same gauge or larger, and that all connections are soldered and taped, or covered with heat-shrinkable tubing.

The main wiring harness contains the following connections:

- Idle Air Control Motor (square 4-pin female, Black connector)
- Throttle Position Sensor (3-pin male, Black connector)
- Manifold Absolute Pressure Sensor (3-pin male, Green or Orange)
- Intake Air Temperature Sensor (2-pin male, Gray connector)
- Engine Coolant Temperature Sensor (2-pin male, Black connector)
- Heated Exhaust Gas Oxygen sensor (4-pin, square, Black micro connector)
- Injector Connector (10-pin male, Black connector)
- Ignition Connector (8-pin male, Black connector)
- Malfunction Indicator Lamp (2-pin, micro, Gray connector)
- Self-Test Input (flying lead) Lt. Green/Org.
- CalMap connector (4-pin, micro Black connector)
- Manifold Surface Temperature (2-pin, Black connector)
- Case Ground
- Battery Positive (+) Red
- Battery Negative (-)Black
- Ignition Voltage (flying lead) Pink wire
- * Accessories connector (5-pin male, White connector)
- * NOS connector (5-pin, micro, Gray connector)
- * Knock (ESC) connector (3-pin, Red connector)
- * Shift Light (flying lead) White wire

* Items may require additional optional parts. Consult your dealer for details and part numbers.

Attach each connector to the appropriate sensor. See the Online Drawings and Schematics provided within the CalMap Software Environment (CTRL-F1) for details.

Note: For LT-1 engine kits there are multiple adapter harnesses for the TPS, IAC, and ignition connections.

1.4.7 Starting the Engine

1.4.7.1 Configuring the ECM before Startup

1.4.7.1.1 Load CalMap software

. If your kit included a DFI PowerKey, attach it to your Parallel or USB port before installing the software. Next, locate and load the CalMap software package onto your computer. For proper CalMap loading procedures, table editing, and general instructions, refer to the CalMap Software section of this manual. With the ignition key on, engine off, launch the CalMap software program, and select the 'Online to ECM' button. Once a connection to the ECM is established, press the F6 key to save your global calibration to a file. This will save the entire global file to your computer. Use this file as a backup.

1.4.7.1.2 Edit Configure Tables

Initially, your ECM must be configured for your particular engine combination. To do this, you can make use of the configuration screens with the CalMap software environment. There are screens for System, Controls, Idle and Output configuration. These are accessible by pressing the CTRL-S, CTRL-C, CTRL-I, and CTRL-O key combinations, respectively. For all engine configuration screens, you must make your change, press enter or the return key, then use the F10 key to send the information to the ECM. Select and adjust, if necessary, the following tables:

1. **Reference Inputs – Spark Output (System Configuration Screen)**

Select the ignition type from the list provided that best fits your application. Press F10 to send data. If using a Custom application or if your ignition system is not listed select the Custom setting and press F10. Select and adjust, if necessary, the crank and cam reference input type, edge location, ignition output type, and edge location to match your ignition system. Press the F10 key to send the data to the ECM after it is entered.

2. *Number of Cylinders (System Configuration Screen)*

Select 4,6, or 8 cylinders. Press the F10 key to send the value to the ECM after it is entered.

3. *MAP Configuration (System Configuration Screen)*

Enter 1,2, or 3 Bar, or Alpha-N. The 1 Bar Map is for normally aspirated engines, and can measure up to 0 PSIA or atmospheric pressure. The 2 and 3 Bar sensors are for supercharged or turbocharged applications. The 2 Bar MAP can measure up to 15 PSIA manifold pressure, and the 3 Bar MAP can measure up to 30 PSIA manifold pressure. In Alpha-N mode, the VE table is based on Throttle Position vs. RPM. This mode is recommended only when tuning race engines with extremely low or erratic idle vacuum. Press the F10 key to send the value to the ECM after it is entered.

4. *Exhaust Feedback Sensor (Control Configuration Screen)*

Select HEGO or UEGO. HEGO is a standard four wire, heated O₂ (narrowband) sensor. This lambda sensor can only correct to stoichiometric, or about 14.7:1 A/F Ratio. The HEGO, four wire, O₂ sensor is part of your standard kit. Press the F10 key to send the value to the ECM after it is entered.

A UEGO is a five-wire (wideband), linear O₂ sensor. The Accel/DFI wideband sensor can measure actual A/F ratios from 10:1 to 20:1. The UEGO, Type 2 wide band O₂ P/N 77063 is an accessory option. Along with the standard Gen 7 connections, the Type 2 unit also has provisions for a voltage output. Any digital or analog voltage gauge will read this module output voltage as actual A:F. For example, if the unit measures 12.7:1 actual air/fuel ratio, the voltage gauge pod or voltmeter would read 12.7 volts. With this new feature, the unit can be used as a standalone unit for most gasoline applications.

5. *Ignition system delay (System Configuration Screen)*

This value allows for the compensation of all of the ignition delays in the system. If the measured ignition advance tends to wander from the forced timing value commanded through CalMap as speed increases then this value needs to be modified. If the advance becomes increasingly less than the total advance displayed on CalMap as engine speed increases then this value should be increased. If the advance becomes increasingly more than the total advance displayed on CalMap as engine speed increases then this value should be decreased.

For most applications, set this period to 100-125us. Press the F10 key to send the value to the ECM after it is entered. To adjust this table, start the engine and force the ignition timing by checking the forced timing box on the

instrument screen. Next enter the ignition timing at the highest engine load, usually peak torque. Rev the motor approximately 1/2 of its maximum expected RPM, and check the timing variance between the forced value and the dampener reading. The value on the dampener should be the same as the value entered in the software across the entire RPM range. Raise or lower the number in this table to achieve this.

6. Ignition Limit Status (Control Configuration Screen)

The 2-Step Rev Limit utilizes a sequential (soft-touch) ignition rev limiting strategy, that when activated, will not allow the engine speed to surpass a user defined, or preset RPM. Enter an engine speed in this table, from 2250 to 12,750 RPM. To enable this feature, a 12-volt source, usually from a transmission brake solenoid, or a line lock must be applied to Pin 'C' on the five-pin accessory connector or K3 on the main header. This function will deactivate when this 12-volt source is removed. Press the F10 key to send the value to the ECM after it is entered.

7. Ignition Cut-Off Speed (Control Configuration Screen)

When the engine speed exceeds this value, sparks begin to be eliminated. The number of sparks dropped is a function of how far above the rev limit value that the actual RPM is. The RPM range is 2000-12,750. Press the F10 key to send the value to the ECM after it is entered.

8. Fuel Cut-Off Speed (Control Configuration Screen)

When the engine speed exceeds this value fuel will be turned off. It will be turned back on once the engine speed falls below the Fuel Restore Speed. Note: This feature is not recommended for supercharged and turbocharged applications. Do not invoke the fuel shutoff function when manifold pressure is positive; unless the max, fuel on value is set very low (i.e. idle). This will give time for the impeller speed to slow down, decreasing manifold pressure, and the occurrence of a lean condition. The RPM range is 2000-12,750. Press the F10 key to send the value to the ECM after it is entered.

9. Fuel Restore Speed (Control Configuration Screen)

Once the fuel is shut-off due to exceeding the engine speed specified for fuel cut-off speed, it will remain off until the engine speed falls below this value. Always enter a value lower than Fuel Cut-Off Speed. The RPM range is 2000-12,750. Press the F10 key to send the value to the ECM after it is entered.

10. Engine Displacement (System Configuration Screen)

Enter your engine displacement in cubic inches. The range is 55 to 825cid. Press the F10 key to send the value to the ECM after it is entered.

11. **TPS Set Point, Closed Throttle Offset Voltage (System Configuration Screen)**

Click on the TPS Setpoint button. A pop-up screen will be displayed. In the bottom center of this display current TPS voltage and TPS percent are monitored. With the ignition key on or in the switched position, engine off, and the throttle in a closed position. Follow the on-screen instructions to program your closed throttle (Low) setpoint voltages. The ECM will create a smooth or linear TPS curve that transitions from 0 to 100 percent. This function will offset any non-linearity in the throttle linkage. This feature will be beneficial when setting other functions dependent on throttle position. These values will always be displayed in percent TPS.

12. **TPS Set Point, Wide Open Throttle Offset Voltage**

With the ignition key on, or in the switched position, engine off, and the throttle floored, or in a fully open position, follow the on-screen instructions to set your wide open throttle position (High) setpoint.

13. **Return or Returnless Fuel System Select (System Configuration Screen)**

In order to set this parameter properly, you must first determine if your fuel rail pressure is referenced to manifold pressure. Most applications are return fuel systems. These systems have a fuel regulator mounted in the engine compartment. The regulator is usually referenced to the intake manifold via a vacuum line, with a fuel return line plumbed back to the gas tank. In returnless fuel systems, the regulator is located near the pump, usually in the gas tank. These fuel systems are typically found in newer cars, ('97 and up) and do not reference fuel rail pressure to manifold pressure. Press the F10 key to send the value to the ECM after it is entered.

14. **Fuel Injection Type (System Configuration Screen)**

Enter the fuel injection mode or strategy in which you want the injectors to fire. Press the F10 key to send the value to the ECM after it is entered.

14.1 In the **Sequential** injection mode, injectors fire once every two crank revolutions. The injectors fire in a predetermined order defined in the Injector Firing Order menu. A Cam input must be used to start the injector sequence accurately. If no cam input is detected, the ECM will set an error code #72, and force a cam trigger. Accel recommends using staggered batch mode when a cam sensor is not available. Also in sequential mode, the injector timing can also be adjusted through the use of the Target Injector Timing table in the fuel menu. All injectors must be the same size and there should always be one injector per cylinder.

14.2 In the **Staggered Batch** injection mode, no cam signal is needed. This method of injection is sometimes referred to as bank to bank injection. Each bank of injectors will fire once per crankshaft revolution, and will be out of phase 180 crankshaft degrees. For example, on an eight cylinder engine,

referencing the Injector Firing Order table, the first four injectors listed will fire, then the second four will fire, 180° out of phase from the first bank. All injectors must be the same size and there should be one injector per cylinder.

14.3 In the **TBI** injection mode, two banks of two injectors are used, or a total of four injectors. This TBI or Throttle Body Injection strategy, fires each bank of injectors twice per crank revolution. Referencing the Injector Firing Order table, the order of primary and secondary bank firing will be determined. The primary bank will operate until the duty cycle reaches 80%. At this point the primary and secondary bank will begin to operate at half the rated duty cycle. This strategy delivers a seamless transition of fueling between primary and secondary banks. As soon as duty cycle decreases below 30%, the secondary bank ceases to function and the primary bank takes over. This fueling scheme is very helpful when calibrating a progressive linkage throttle body. It decreases the circumstance of injecting fuel on a closed throttle butterfly, thereby lowering the chance of fuel puddling. This 'fuel puddling' phenomenon could cause the engine to misfire upon tip-in of the throttle. TBI mode does not require a cam signal, and all injectors must be the same size.

14.4 **Staged Sequential** Injection (Four Cylinder Applications Only). This injection strategy will use the first 4 fuel injectors as the primary injector bank to fuel the engine for normal 4-cylinder applications. Injectors 5-8 will be applied as a secondary set when the value specified in the TPS threshold table is exceeded (if enabled). If the TPS threshold function is not enabled, or the TPS threshold is not reached before the primary duty cycle reaches 80%, the secondary set of injectors will be activated.

14.5 **Dual-Quad TBI** Injection. This injection strategy will use the first 2 fuel injectors as the primary bank to fuel throttle body #1. Injectors 3 and 4 will be used as the secondary bank on throttle body #1. Injectors 5 and 6 will be used as the primary injectors on throttle body #2. Injectors 7 and 8 will be used as the secondary injectors on throttle body #2. All operations of the staging functions are similar to TBI Mode.

Note that in this configuration, only 1 Throttle Position Sensor and 1 Idle Air Controller are required.

15. **Crank Index Offset (degrees) (System Configuration Screen)**

Enter a number in crank degrees. This number should be the distance in crank degrees, between the pickup sensor and trigger tooth. The maximum value should never exceed the lowest timing advance value in your base timing map. This table is especially handy when timing engines with fixed trigger inputs (i.e. Buick GN applications). This application would have a built-in advance of 10 crank degrees; therefore the value in the offset table should be set to 10 degrees. A simple method to set this value is, once the engine is running, match the total timing advance value (TADV) in your

CalMap instrument screen, to the timing mark on your harmonic balancer by entering a value in the Crank Pickup Offset table. If the distributor reluctor is installed at 0°, then the Crank Index Offset should be set to 0°. The maximum value for this table is 20 degrees BTDC.

16. *Injector Firing Order (System Configuration Screen)*

This table establishes the sequence in which your injectors will fire. To determine this sequence, identify the physical placement of each injector. Above each injector connector on the injector harness, there is a white identifying tab with a number. Match this number (1-8) to a corresponding number in your Injector Firing table. Always enter '1' as your first number in this sequence, and always list as many numbers as the number of cylinders in all modes, except for TBI. For example, a typical Chevrolet application would have an injector firing order of 18436572. Enter this number as a text string, with no spaces or hyphens. This table is interpreted differently for different fuel modes. In sequential fuel mode, the first component of the table will correspond to the first injector (1). This injector will fire after receiving a cam pulse. The important point is that you have all the numbers in the table filled out. For all multiple bank modes, TBI, Staggered Batch, and Staged Sequential injection, the sequence in the table will correspond to the primary and secondary banks. For example, in Staggered Batch mode, if you have a Chevrolet eight cylinder engine, the primary bank would have injectors 1-3-5-7, the secondary bank would have injectors 2-4-6-8. You would enter 13572468 in the Injector Firing Order table. In TBI mode, always assume a total of four injectors. The primary bank would have injectors 1-2, secondary bank would have injectors 3-4. Enter 12345678 in the table.

NOTE: This table must be accurate upon startup. It is up to the operator to ensure that the firing order configuration is valid. If this table is not accurate, complete, or valid, the ECU will not function properly, or the engine will not start. **All injectors must be accounted for in the firing order. If you are only using 4 or 6 injectors, enter the numbers for the remaining unused injectors at the end of your firing order. The ECM will not function properly if the firing order table contains less than 8 numbers, and no number may be used twice.**

17. *Injector Flow Rate (System Configuration Screen)*

Enter a value in pounds per hour. This value should be the actual flow rate of the injector at 45 psi or 3 BAR. Some of the injectors on the market are underrated on this value. During the speed density calculation process, this condition could cause abnormally low numbers in the base VE table. Press the F10 key to send the value to the ECM after it is entered.

18. *Compression Ratio (System Configuration Screen)*

Enter the compression ratio of the engine. For example, if the ratio is 8.50:1, enter 8.50. Press the F10 key to send the value to the ECM after it is

entered. Press the F10 key to send the value to the ECM after it is entered.

19. Fuel Line Pressure (System Configuration Screen)

Enter the static fuel line pressure in pounds per square inch (PSI). Measure this value with an accurate test instrument. Typically, this value can be measured two ways. First, with the vacuum line removed from the fuel regulator and engine idling. And second, with the engine off and the fuel pump energized for more than 15 seconds. Do not attempt to set the regulator during the priming cycle of the ECM, erroneous measurements will occur due to the brevity of this cycle period. Press the F10 key to send the value to the ECM after it is entered.

20. Fan On Temperature (Output Options Configuration Screen)

Enter a number in degrees (F). This is the high temperature threshold, or point at which the coolant fan relay is activated. Press the F10 key to send the value to the ECM after it is entered.

21. Fan Off Temperature (Output Options Configuration Screen)

Enter a number in degrees (F). This is the low temperature threshold, or point at which the coolant fan relay is de-activated. This table value must always be lower than the Fan On Temperature value. Typically, a value 9* to 15* lower than the Fan On Temperature is acceptable. Press the F10 key to send the value to the ECM after it is entered.

22. Base Offset Injector timing (Fuel Menu ->Steady State)

Note: Not used in Version 3_2 or higher ECM's (See Target Injector Timing). Only valid in the Sequential Injection Mode. For setting earlier version ECU's follow the instructions listed below.

This table value, displayed in crank angle degrees, specifies the offset point that the Injector Target timing table indexes. This value generally would be the intake valve closing angle, in crank degrees. In order to set this value, obtain the Camshaft Information Card for your engine. As an example, we will use the ACCEL 74219 camshaft for a small block Chevrolet V8. Locate the angle at 0.050 tappet lift at which the intake valve closes. This is usually read in crank degrees, (ABDC) after bottom dead center. Since the cam card shows the intake valve closing point at 41*ABDC, and we know the crank angle at BDC intake stroke is 540* on a Chevrolet V8, we can calculate the exact angle in crank degrees at which the intake valve closes. Simply combine these figures, 41* and 540* to net a crank angle intake closing timing of 581* @ 0.050" valve lift. Enter 581 in the table. The ECM will round this value to the nearest factor of 10, so the ECM will display 580. Enter a value between 0 and 720.

23. **Target Injector timing (Fuel Menu -> Steady State)**

A. *Version 3_1 and earlier ECMs in Sequential Injection Mode Only .*

This table contains fuel injector target timing values for all possible engine speeds and engine loads. Enter a number between 0 and 720 degrees. This value, displayed in crank angle degrees, designates the end of inject point of the fuel injector. Using the injector target timing we are assured that the injection event will not coincide with the intake valve, opening event, unless the duty cycle of the injector overlaps the event. Typically, end of inject point should occur before the intake valve opens. Under light load conditions, if the intake valve is open during an inject cycle, poor atomization, or improper mixing of fuel will occur. This could cause driveability and exhaust emission related problems that can not be tuned out by the operator. In order to set this value accurately, obtain the Camshaft Information Card for your engine. As an example, we will use the ACCEL 74219 camshaft for a small block Chevrolet. Locate the intake valve duration at 0.050 tappet lift. The value, 218*, plus the lead-time (in crank degrees), should be used as the base target timing index throughout 4x4 table. This 'lead' time would depend on the distance of the injector to the valve, the size of the injector, the RPM range of the motor, the physical angle in which the injector is mounted to the manifold, and emission restrictions. To promote better atomization of the fuel, you would normally lead this opening event by 90* or more. For this example, we will lead the event by 90*, assuming we are using an ACCEL SuperRam manifold. This manifold utilizes 30#/hr injectors, located in close proximity to the intake valve. Take this lead-time angle, 90*, add it to the original target timing value of 218* to obtain the new target timing of 308*. Enter 308 in the table. . The ECM will round this value to the nearest factor of 10, so the ECM will display 310. The End of inject timing is calculated by the ECM as, Injector Base Offset Timing minus Injector Target timing. In this case the value is (580* - 310*) or 270 crank degrees.

B. *For Version 3_2 or higher ECU's*

This table contains fuel injector target timing values for all possible engine speeds and engine loads. Enter a number between 0 and 720 degrees. This value, displayed in crank angle degrees, designates the start of inject point of the fuel injector. Using the injector target timing we are assured that the injection event will not coincide with the intake valve, opening event, unless the duty cycle of the injector overlaps the event. Typically, start of inject point should occur well before the intake valve opens or just after the intake valve closes. Under light load conditions, if the intake valve is open during an inject cycle, poor atomization, or improper mixing of fuel will occur. This could cause driveability and exhaust emission related problems that can not be tuned out by the operator.

In order to set this value accurately, obtain the Camshaft Information Card for your engine. As an example, we will use the ACCEL 74219 camshaft for a small block Chevrolet. Locate the intake valve closing period in crank degrees after bottom dead center. For our example the event is 41*ABDC. We can determine that the event occurs 41 degrees after BDC (BDC is 540*crank degrees). Using these values we can conclude the intake valve closing angle measured in crank degrees would be 581*. Assuming the injector placement is at or near the intake valve, the start of inject point would occur after the valve is shut. At this time you would enter 580* in the table. This value can be decreased by a large margin to begin start of inject sooner if the placement of the injector is further up the runner of the manifold away from the valve. A few other variables which effect this setting are; Engine RPM, intake runner size and shape, acceleration fueling requirements, and injector spray pattern.

24. Exhaust Closed Loop Enable/Disable (Control Configuration Screen)

This is a master on/off switch for closed loop oxygen sensor operation. Normally, this switch would be left in the closed loop or enabled position for most street applications running unleaded fuel. Depending on the O2 sensor selected, in closed loop, the ECM will add or subtract fuel to maintain a Stoichiometric or Target A/F ratio set in CalMap. In the off or disabled position, no fuel corrections are made. Depending on the sensor, O2 voltage or A/F ratio can be monitored in the disabled or open loop mode. This is very helpful in performance applications using leaded fuel. The O2 feedback can be viewed or data-logged to help calibrate the combination. Press the F10 key to send the value to the ECM after it is entered.

25. Idle Spark min % TPS (Idle Configuration Screen)

Enter a TPS value from 0 to 100. This is the TPS threshold at which the Idle Spark table becomes disabled. The Idle Spark table corrects for small changes in idle speed error by adding or subtracting timing. This is very helpful when calibrating engines with high overlap camshafts. This table is located in the Idle menu. A recommended starting point is 1 to 3 percent. Press the F10 key to send the value to the ECM after it is entered.

26. Startup Term RPM (Ignition Menu -> Starting)

The Startup Termination RPM is the engine speed at which the timing value is switched over from a cranking mode value, to the run-mode value. The crank-mode value is determined by the location of the crankshaft sensor relative to Top Dead Center. The run-mode value is a combination of the base advance table and the startup-phase-in interval. A typical value for the Startup Termination RPM is 350 RPM for a 8 cylinder engine, 450 for a 6 cylinder engine, and 550 RPM for a 4 cylinder engine.

A symptom of this table being set incorrectly is a loss of control over ignition advance. If this happens, try using the Forced Timing table to set a timing

value. If forcing the timing value works, you need to change the value in the Startup Termination RPM table.

1.4.7.2 Create a Fuel Table, (Fuel->Utilities->VE Estimator)

If you have purchased an ACCEL Manifold Kit with matching camshaft, such as a SuperRam, or StreetRam, it is probable that the VE table provided will likely start and run the engine. For most other combinations, if you are starting from scratch, the Utilities menu can help provide you with a starter VE table to get the engine running. Select the Fuel->Utilities->VE Table Estimator menu item from the CalMap software environment. Enter the values as prompted on the screen, and click the CREATE VE TABLE button. A new VE table will be generated based on the information you provided. Follow the on-screen instructions to save this table to your ECM. Remember that this is only a starting point. It allows the operator to start and run the engine. Further calibration or tuning will be necessary to make this table more accurate. Refer to the CalMap tuning instructions for further details, or visit an ACCEL Engine Management Installation Center (EMIC). For a dealer in your area, call 1 (888) MRGASKET, or check the list online at www.mrgasket.com.

1.4.7.3 Pre-check and Starting the Engine

Turn the ignition key to the run position. You should hear the fuel pump cycle on, and then off in 4 seconds. Turn the key off. Repeat this procedure until your fuel system is primed. This usually takes about four repetitions, depending on location of the pump, size, fuel pressure, and length of the fuel lines. If necessary, fuel pressure can be easily measured with a fuel gauge available through your ACCEL/DFI dealer. Before you start the engine, check for leaks throughout the entire fuel system. Start the engine. If the engine does not start after 10-15 seconds, depress the accelerator pedal about a $\frac{1}{2}$ ", to crack the throttle blades open if the engine is slightly rich. Continue cranking. If the engine does not start after 30- 60 seconds, check for the following.

- Check all electrical connections, especially the fuel pump wiring.
- Make sure there are no Fuel Leaks.
- Verify the fuel lines are full of fuel, and that fuel system retains pressure. Some high performance fuel pumps do not incorporate a fuel check valve. In this situation the fuel system will lose pressure when cranking stops.
- Check the initial idle setting of the throttle blades. Open or close slightly if needed.

After checking the items above, if the engine still does not start, reference the Troubleshooting Guide in section 1.5 of this manual.

1.4.7.4 Timing Adjustments

Note: If you are using a fuel-only distributor, skip this step and follow your manufacturer's instructions to set the timing with your distributor.

With the engine running and CalMap on-line, access the instrument panel screen. Locate and monitor the Ignition Timing value on the top right side of your screen. The goal here is to synchronize the timing between the engine and the ECM. To do this, connect a timing light pickup to your #1 spark plug wire. Run the engine, until the coolant (ECT) reaches operating temperature. This is usually between 160 to 195 degrees.

With the engine running, the ECM can be forced to a timing value between 0 and 63.75 degrees BTDC (typically set it to 10*) by checking the Forced Timing checkbox located near the Ignition Timing indicator on the main instrument screen. While the engine is operating at a known timing value, you can physically set the timing on the engine to match the value that the ECM is commanding, by turning the distributor. You may enter the desired timing value when prompted by the dialog box at the center of the screen. For example, if you force the timing to 10* you should adjust the distributor so that the harmonic balancer reads 10*

To synchronize timing control, follow these steps:

1. Place a check in the Forced Timing Checkbox on the instrument screen.
2. Enter a safe timing number -- 10 degrees BTDC recommended -- to hold the engine at while you synchronize the distributor to the number you have FORCED timing to. Use a timing light to verify that the balancer matches the value you have entered.
3. Tighten the distributor lock down clamp.
4. If the timing values still don't match, you may need to modify the Crank Offset table on the System Configuration Screen until these values match. The maximum value in this table should not exceed the total advance of the engine in crank degrees minus 6.
5. Uncheck the Forced Timing checkbox. The engine timing is now synchronized with the ECM timing.

1.4.7.5 Throttle Adjustments

The position of the throttle blades relative to the position of the Idle Air Control Motor actuator plug must be set correctly. The relationship between the two is critical in controlling idle, acceleration, and deceleration

characteristics of the motor. A brief description of operation will help you understand how to adjust this function. The function of the IAC motor is to bypass air around the throttle blades. Since the starting position of the throttle blades does not change, the IAC valve position changes to compensate for changes in idle demand or load. When the IAC opens, it bypasses more air around the throttle blades and when it closes, less air is bypassed. Under certain conditions, usually during cold idle, the throttle body will emit a high frequency hissing sound. This is actually caused by the air reaching sonic velocity traversing through the entry hole in the throttle body. This phenomenon can be monitored as the engine warms up. As coolant temperature (ECT) rises, demand or load decreases, causing the IAC to close. The ideal setup would bypass the least amount of air during no load conditions.

To properly set this relationship, make sure the engine is at operating temperature. Access the Target Idle Speed table in CalMap. Adjust the values in the table to best fit your application. Ordinarily, idle speeds will generally increase as coolant temperature decreases. Target idle speeds will also need to increase with increased camshaft duration. Consult your cam supplier for further information. Next, check and verify that all accessories are off, the transmission is in neutral or park, and the parking brake is set.

Next, select the Minimum IAC position vs. Coolant temperature table. Set the value at normal operating temperatures to about 5%. Monitor the IAC position value at the right side of your screen. Adjust the throttle blades to bring the Actual IAC position value to 6%. To lower the actual IAC position, open the throttle blades. To raise the Actual IAC position, close the blades. If the target idle speed does not match the engine idle speed when the IAC position is set, then the throttle bores are distorted, a vacuum leak is present in the intake manifold, or the throttle blades need to be drilled. Once the throttle blades have been adjusted, the TPS Set Points must be re-calibrated. To reset these tables, refer to the TPS Set Point Low, and High Offset Voltage tables in the Configure ECM section. For further tuning or calibration information, reference the CalMap Tuning section in this manual.

1.5 Troubleshooting

1.5.1 Diagnostic Error Codes

1.5.2 End of Inject Profile

1.5.3 No Spark At Plugs

1.5.4 Engine Runs Lean

1.5.5 Engine Runs Rich

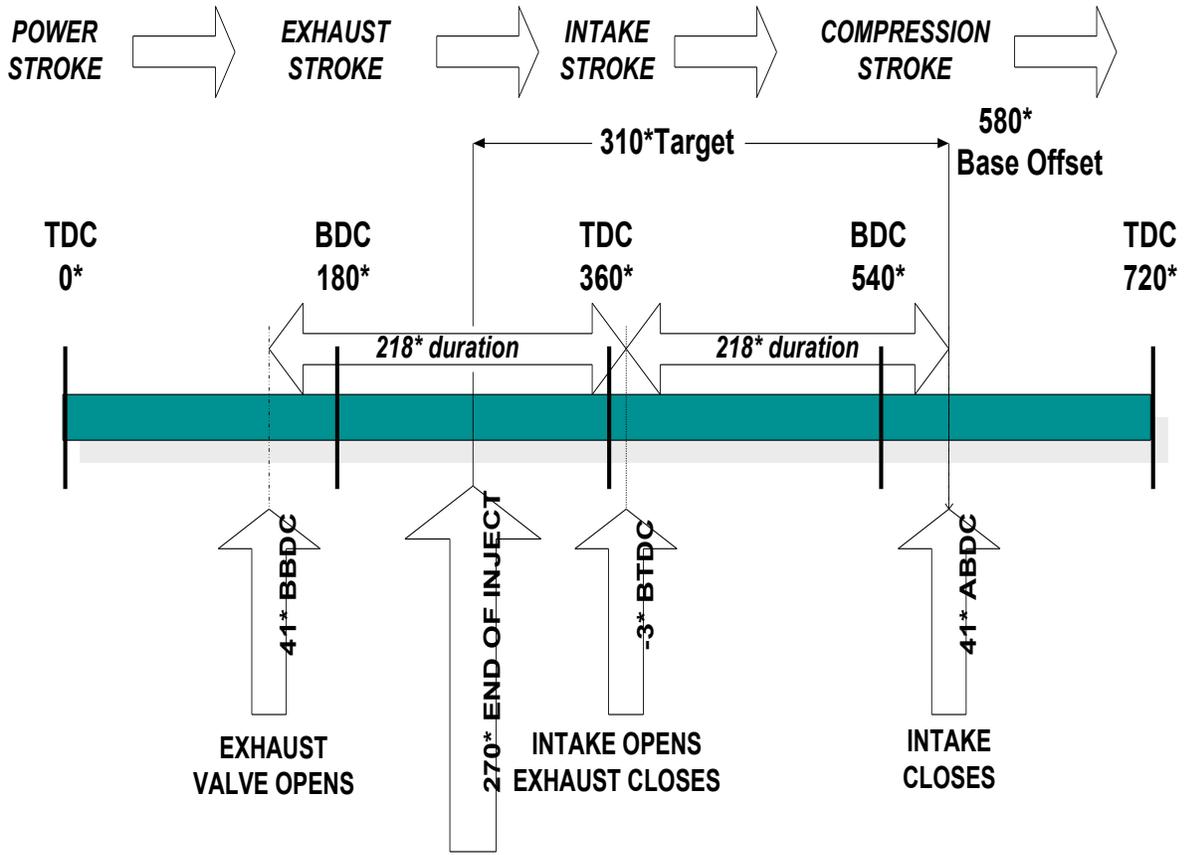
1.5.6 Ignition System Settings

1.5.7 Diagnostic Waveforms

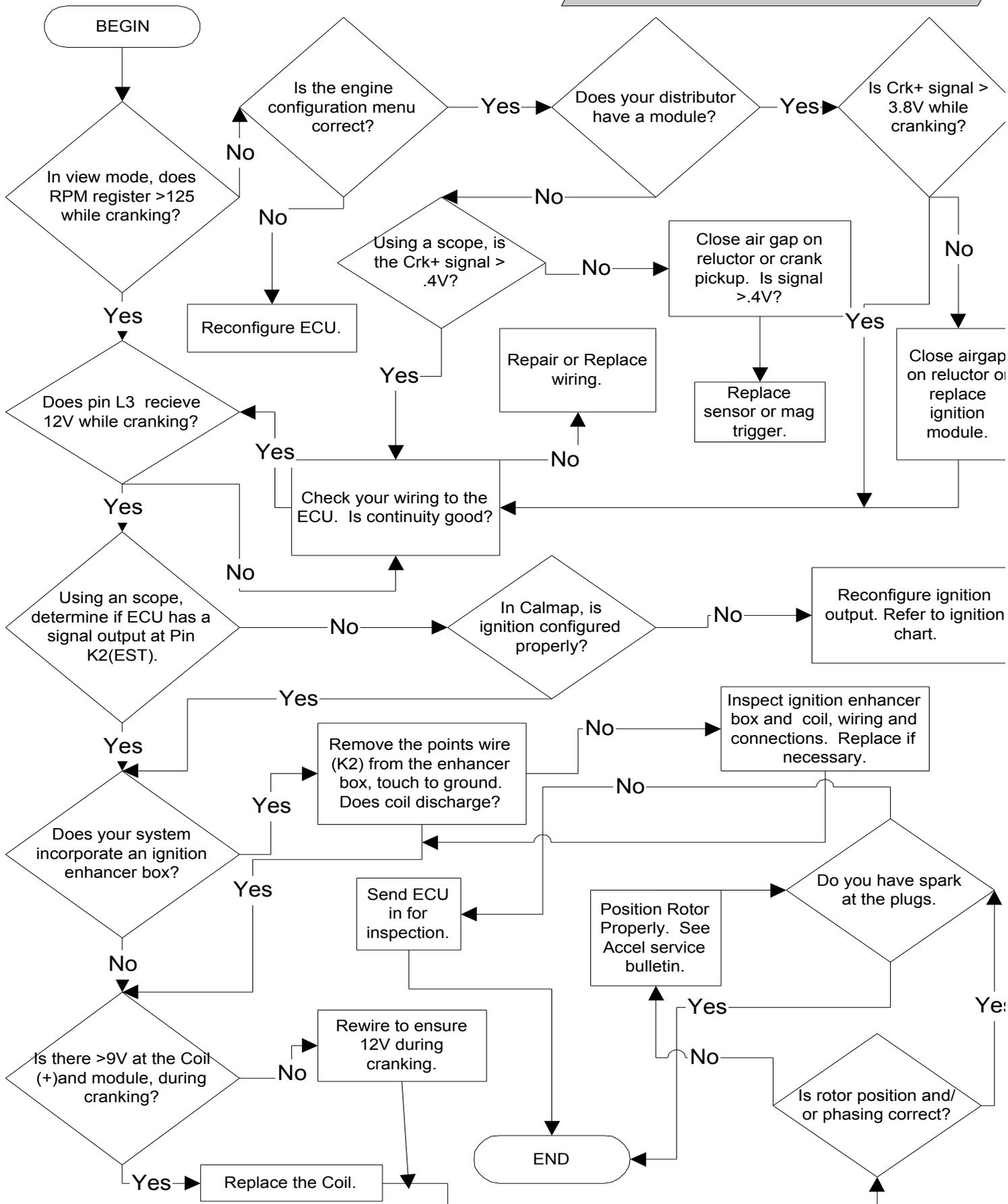
Code	DESCRIPTION	THRESHOLD	DEFAULT RESPONSE
21	Low ignition (Vigt) voltage	If voltage is less than 8.9V for more than 2 seconds after engine speed exceeds 650 RPM for more than 50 crankshaft revolutions.	MIL set, no default action
22	High ignition voltage	If voltage is greater than 17.9 volts for more than 2 seconds.	MIL set, no default action
23	Low throttle position (TPS) voltage	TPS voltage less than .20V for more than 2 seconds	MIL set, TPS defaults to 1.3V
24	High throttle position voltage	TPS voltage greater than 4.88V for more than 2 seconds	MIL set, TPS defaults to 1.3V
25	Low manifold pressure (MAP)	If MAP voltage drops below .10V for more than 2 seconds	MIL set, MAP defaults to half of full scale.
26	High manifold pressure	If MAP is greater than 4.92V (1 Bar), 3.98V (2 Bar), 3.04V (3Bar) for more than 2 seconds, after engine speed is below 900 RPM	MIL set, MAP defaults to half of full scale.
31	Low barometric pressure (BAR)	If Barometer threshold trigger is less than 2.5V (~66kPa) for more than 1 second	MIL set, Barometric pressure default to 102 kPa
32	High barometric pressure	If Barometer threshold trigger is greater than 4.94V (~107kPa) for more than 1 second.	MIL set, Barometric pressure default to 102 kPa
33	Exhaust sensor stuck low	If sensor voltage remains less than .10V for more than 32 seconds. (In Closed Loop operation only)	MIL set, default to Open Loop Fueling
34	Exhaust sensor stuck high	If sensor voltage remains above .96V (HEGO), or 4.75V (UEGO) for more than 32 seconds. (In Closed Loop operation only.)	MIL set, default to Open Loop Fueling
35	Exhaust sensor inactive	If exhaust sensor voltage does not change by more than .06V in 32 seconds.	MIL set, default to Open Loop Fueling
36	Knock module stuck low	If the Knock ignition retard limit is not equal to 0, and the signal remains low for more then 15 seconds.	MIL set, default to 0 Knock retard, ignore Knock module.
41	High ECT(Engine Coolant Temperature) signal	The coolant temperature sensor voltage remains below .06V for more than 1 second.	MIL set, default ECT to 50 F.
42	Low ECT (Engine Coolant Temperature) signal	The coolant temperature sensor voltage remains above 4.94V for more than 1 second.	MIL set, default ECT to 50 F.
43	Low IAT (Intake Air Temperature) signal	The IAT sensor voltage remains below .06V for more than 2 seconds.	MIL set, default IAT to 50 F.
44	High IAT (Intake Air Temperature) signal	The IAT sensor voltage remains above 4.94V for more than 2 seconds.	MIL set, default IAT to 50 F.
45	Low MST (Manifold Surface Temp.) signal	The MST sensor voltage remains below .06V for more than 2 seconds.	MIL set, default MST to 50 F.
46	High MST (Manifold Surface Temp.) signal	The MST sensor voltage remains above 4.94V for more than 2 seconds.	MIL set, default MST to 50 F.

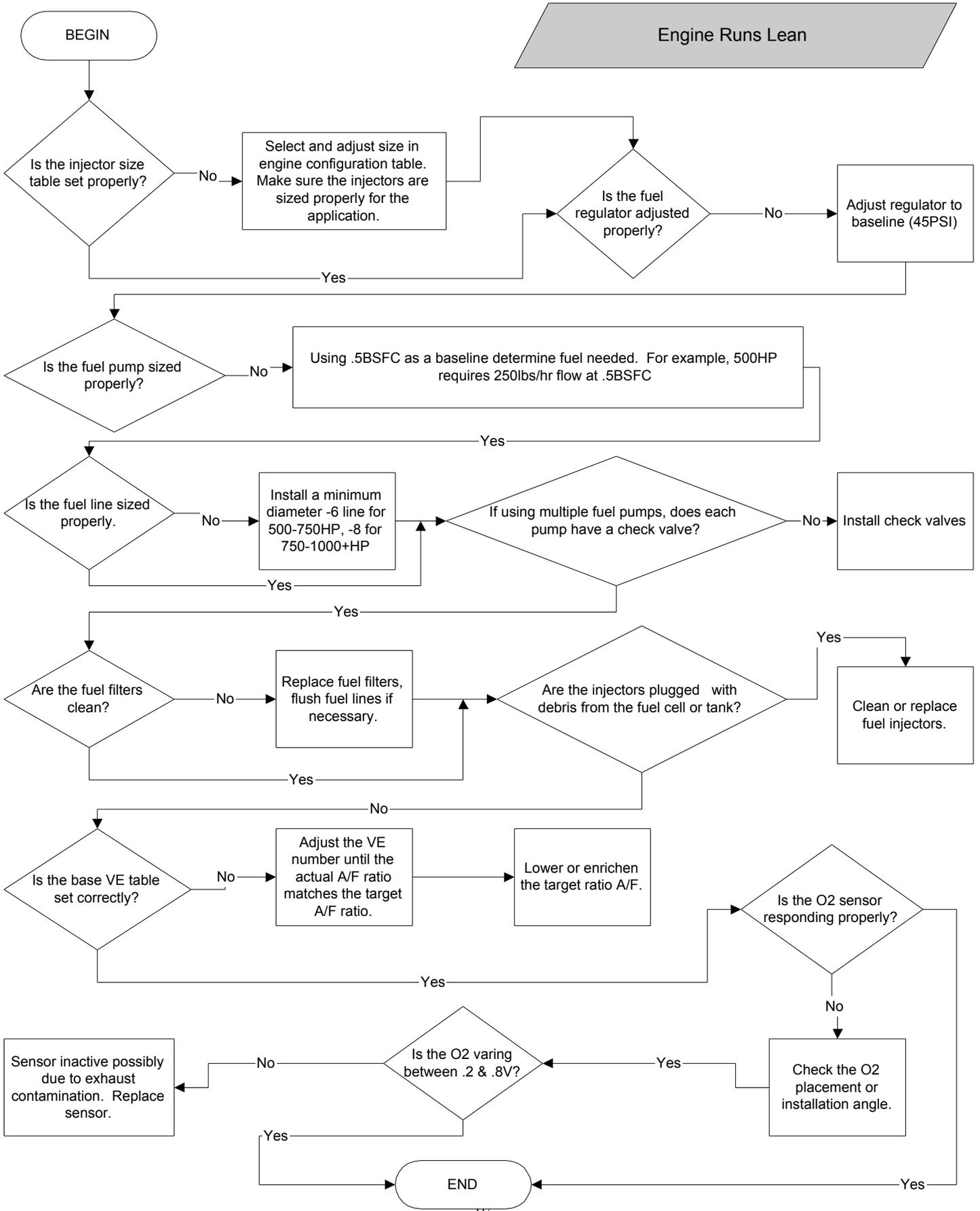
51	5 Volt Reference out of range	5 Volt reference exceeds 5.5V or drops below 4.5V.	MIL set, set all sensors to default values
52	Air Conditioning Clutch (ACC) relay driver over current	Driver current exceeds .5 Amps	MIL set, shut output driver off
53	Malfunction Indicator Lamp (MIL) over current	Driver current exceeds .5 Amps	MIL set, shut output driver off
54	Shift Light driver over current	Driver current exceeds .5 Amps	MIL set, shut output driver off
55	Torque Converter Clutch (TCC) control relay driver over current	Driver current exceeds .5 Amps	MIL set, shut output driver off
56	Fan control relay driver over current	Driver current exceeds .5 Amps	MIL set, shut output driver off
61	Program Execution, illegal interrupt	ECM program error	MIL set, no default action
62	Program Execution, illegal operation	ECM program error	MIL set, no default action
63	Program Execution, (COP), Computer operating properly	ECM program error	MIL set, no default action
64	Stage #1 NOS driver over current	Driver current exceeds .5 Amps	MIL set, shut output driver off
65	Stage #2 NOS driver over current	Driver current exceeds .5 Amps	MIL set, shut output driver off
66	Ignition output driver over current	Driver current exceeds .5 Amps	MIL set, shut ignition off
71	Static Injector Condition	Injector duty cycle exceeds 100% on at least one injector	MIL set, Disable NOS operation, No default under standard operation
72	Cam / Crank Error	Cam or Crank error is detected	MIL set, ECM forces CAM position. If ECM is restarted before error is cleared, cam startup sequence is random.

END OF INJECT PROFILE



No Spark at Plugs





Engine Runs Lean

BEGIN

Is the injector size table set properly?

No

Select and adjust size in engine configuration table. Make sure the injectors are sized properly for the application.

Is the fuel regulator adjusted properly?

No

Adjust regulator to baseline (45PSI)

Yes

Is the fuel pump sized properly?

No

Using .5BSFC as a baseline determine fuel needed. For example, 500HP requires 250lbs/hr flow at .5BSFC

Yes

Is the fuel line sized properly.

No

Install a minimum diameter -6 line for 500-750HP, -8 for 750-1000+HP

If using multiple fuel pumps, does each pump have a check valve?

No

Install check valves

Yes

Are the fuel filters clean?

No

Replace fuel filters, flush fuel lines if necessary.

Are the injectors plugged with debris from the fuel cell or tank?

Yes

Clean or replace fuel injectors.

Yes

No

Is the base VE table set correctly?

No

Adjust the VE number until the actual A/F ratio matches the target A/F ratio.

Lower or enrichen the target ratio A/F.

Is the O2 sensor responding properly?

No

Check the O2 placement or installation angle.

Sensor inactive possibly due to exhaust contamination. Replace sensor.

No

Is the O2 varing between .2 & .8V?

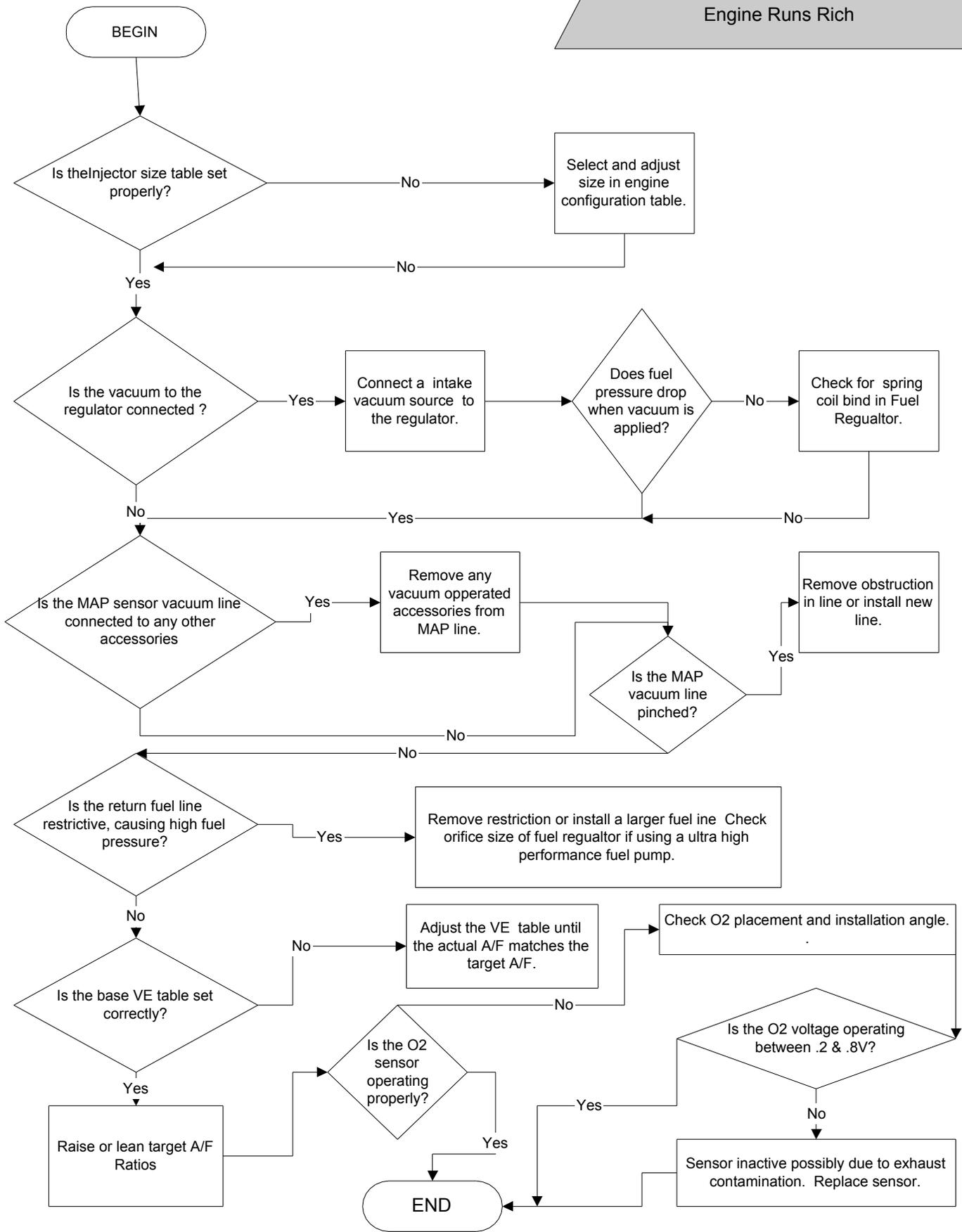
Yes

Yes

END

Yes

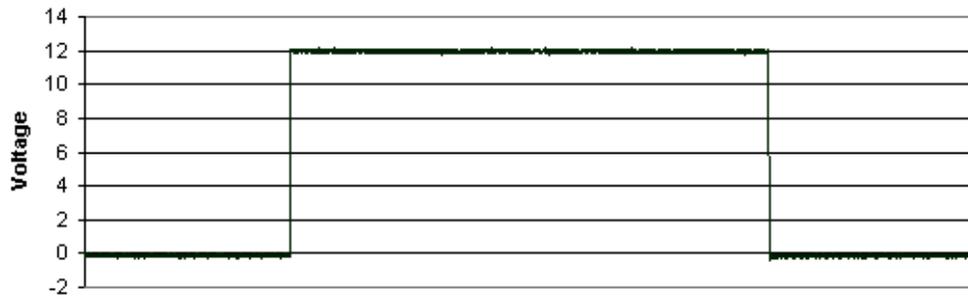
Engine Runs Rich



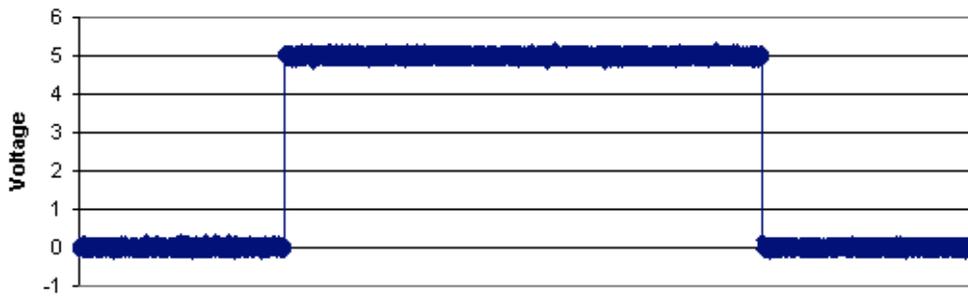
Distributor or Crank Trigger Type	Reference Input Signal Type	Reference Input CRK Trigger Edge	Reference Input CAM Trigger Edge	Spark Out Trigger Edge	Spark Out Trigger Type
DFI Dual-Sync Distributor (Hall Effect)	Hall Effect	Falling	Falling	Rising	Sink, Points (Open Collector)
GM (HEI), High Energy Ignition	5V/Vigt - Digital Square Wave	Falling	N/A	Falling	5 Volt Digital Square Wave
Universal (IPU), Inductive Pickup	Bipolar pulse (IPU, Flying Magnet)	Falling	N/A	Rising	Sink, Points (Open Collector)
Universal (IPU) with cam sync signal	Bipolar pulse (IPU, Flying Magnet)	Falling	Falling	Rising	Sink, Points (Open Collector)
Universal (HE), Hall Effect	Hall Effect	Falling	N/A	Rising	Sink, Points (Open Collector)
Universal Hall Effect with cam sync	Hall Effect	Falling	Falling	Rising	Sink, Points (Open Collector)
GM (LT1) with opti-spark	Hall Effect	Rising	N/A	Falling	5V Digital Square Wave
Ford (TFI), Thick Film Ignition	5V/Vigt - Digital Square Wave	Rising	N/A	Rising	Vigt Unipolar Digital Square Wave
Honda VTEC, (IPU distributor)	Bipolar pulse (IPU, Flying Magnet)	Falling	Falling	Rising	Sink, Points (Open Collector)
Buick GN V6,DIS, coil packs	5V/Vigt- Digital Square Wave	Rising	Rising	Rising	5V Digital Square Wave
Universal Crank Trigger (includes Flying Magnet, Flying Lug)	Bipolar pulse (IPU, Flying Magnet)	Falling	Falling	Rising	Sink, Points (Open Collector)
Universal Hall Effect Crank Trigger	Hall Effect	Falling	Falling	Rising	Sink, Points (Open Collector)
Enhancer Ignition Box (ie. 300+,MSD) Tach Output Signal (Fuel ONLY)	5V/Vigt -Digital Square Wave	Rising	Falling	N/A	N/A
Ford EDIS Compatible	5V/Vigt Digital Square Wave	Rising	Rising	Falling	EDIS Compatible

Ignition Coil -Neg. Terminal (Fuel ONLY)	5V/Vigt -Digital Square Wave	Rising	Falling	N/A	N/A
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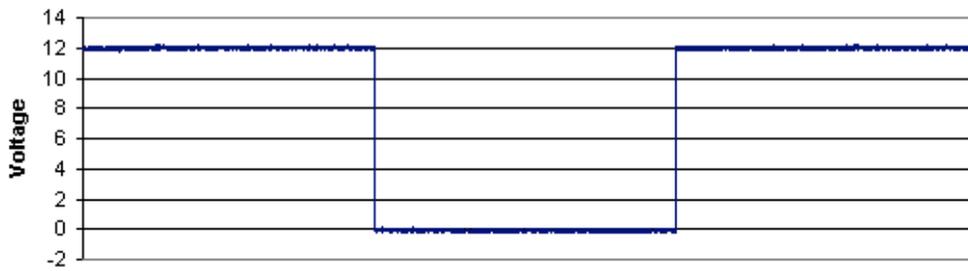
12 Volt Square Wave



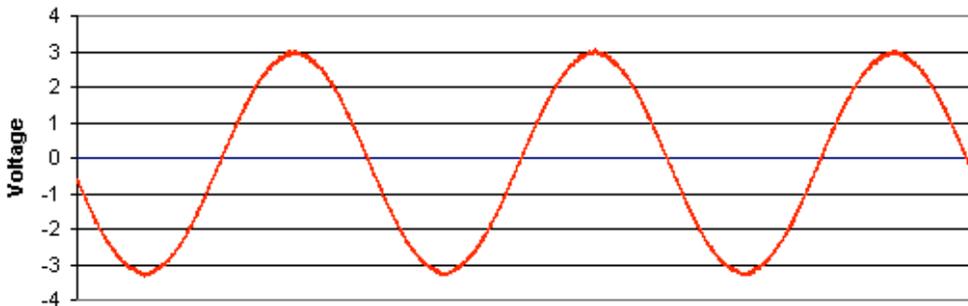
5 Volt Square Wave



Vigt Open Collector



Bipolar Pulse (VRS)



CalMap Software Guide

CalMap Minimum Computer System Requirements

- Microsoft Windows 98 (Second Edition), 2000, XP or better operating systems.
- Intel Pentium II processor, 400 MHz or faster or equivalent. Pentium III Processor or higher recommended.
- 64 MB of RAM.
- Monitor Resolution of 800x600 pixels, 1024x768 recommended.
- One serial communications port, properly configured through your operating system.
- One Parallel or USB port for Standard or Pro DFI PowerKey.

Installation Instructions

Locate the CalMap CD provided with your system and insert it into your computer's CD-ROM Drive. If your CD is misplaced or damaged, you can always download the latest version of CalMap from the Mr. Gasket Performance Group website, at www.mrgasket.com. Follow the ACCEL/DFI link to the software downloads area. If your kit came with a DFI PowerKey, you must install it on the Parallel or USB port of your computer before loading the software. Double-click on the 'My Computer' Icon located on your Windows Desktop, and Execute the program 'Setup.EXE' from your computer's CD-ROM Drive. Select the desired location(s) to install CalMap and it's associated files, and follow the on-screen instructions. Click the 'Finish' button on the screen to continue the installation process. Reboot your computer if necessary to complete the installation.

Launching the CalMap Software

After the installation is complete, a shortcut to the CalMap executable will be placed on your computer's desktop. Double click on the shortcut to CalMap in order to run the program. To communicate with an ECM, the CalMap Communication Cable must be connected to a properly configured serial communication port on the Computer, and to the ECM. The ECM must be powered up in a 'key on' or 'running' mode in order to communicate properly with CalMap.

Getting Started with CalMap

After double clicking on the CalMap Icon, the splash screen shown in Figure 1 will be displayed. Data can be edited in one of two modes: directly from the Engine Control Module, or in a 'virtual ECM' stored in your computer's memory.

Editing Data Online from an ECM

The 'Online to ECM' option requires that a functioning Engine Control Module be connected to a valid serial communications port on your computer. CalMap will automatically detect the presence of an ECM on either port 1 or 2 on your computer. To use an alternate port, click on the 'Online to ECM' button with your *right* mouse button, and enter the number of the port that you want to use. If your computer does not have any serial ports, you will require a USB-to-Serial converter device, such as the KeySpan

UPR-112 model. These devices are available at most computer/electronics/appliance stores.

When editing data online, from an ECM, the engine is not required to be running, but the key must be in the on position. Data is changed directly in the ECM memory, and in most cases engine operation can be immediately affected by the changes.

Editing Data from a Calibration File

The 'Offline from File' option does not attempt to communicate directly with an Engine Control Module. Data is loaded from a global calibration disk file into a 'virtual ECM' stored in Random Access memory inside your computer. Changes made to ECM data are stored in memory, and must be saved to the global calibration disk file before CalMap is exited. At some later time, the same calibration file may be sent to the ECM, changing all the data values at one time. Note that the only difference in functionality between offline and online data editing is that none of the real-time instrumentation will work when editing data offline.

Using the Mouse or the Keyboard, select the appropriate button to determine the source of the ECM data that you wish to edit, or select the 'Exit CalMap' option to exit CalMap and return to the computer operating system.



Figure 1: CalMap Startup Screen

The CalMap Calibration Environment

Once the appropriate source for ECM data has been selected, the Instrument Panel screen shown in Figure 2 will be displayed. CalMap will now attempt to communicate with the ECM via a serial communications port on the computer. If communication is successfully established, there will be no messages displayed on the screen. If communication with the ECM could not be established, a message box will be displayed and communication with the ECM will be terminated. In this case, be sure that the communication cable is properly connected to the computer, and to the ECM in the vehicle. Also be sure that power and grounds to the ECM are properly wired, and that the ignition switch is in the on or run position. Press the 'Online to ECM' button to try to re-establish communications with the ECM after the cable and power connections have been verified.

When communication with the module is established, the instrument panel indicators will display real-time values as monitoring data is read from the ECM. If you are editing data offline, no data will be displayed.

The ECM monitor screen is divided into three distinct sections: Menu Bar, Instrument Panel, and Monitor Panel.

The CalMap Menu and Toolbar

Program navigation is achieved through the use of a menu bar just like any application that uses a version of the Microsoft Windows Operating system. To perform an operation via the menu bar, select an item using the mouse or via keyboard shortcuts such as pressing the 'ALT' key and the 'F' key to access the file menu. The row of small icons below the menubar is called the CalMap Toolbar. Each of these icons represents a shortcut to various screens within the program. A brief description of each button is made visible by holding your mouse cursor steady over a button for about 1 second. Press the button to go to the screen. Also, see the Keyboard Shortcuts section for more on various key combinations and their functions.

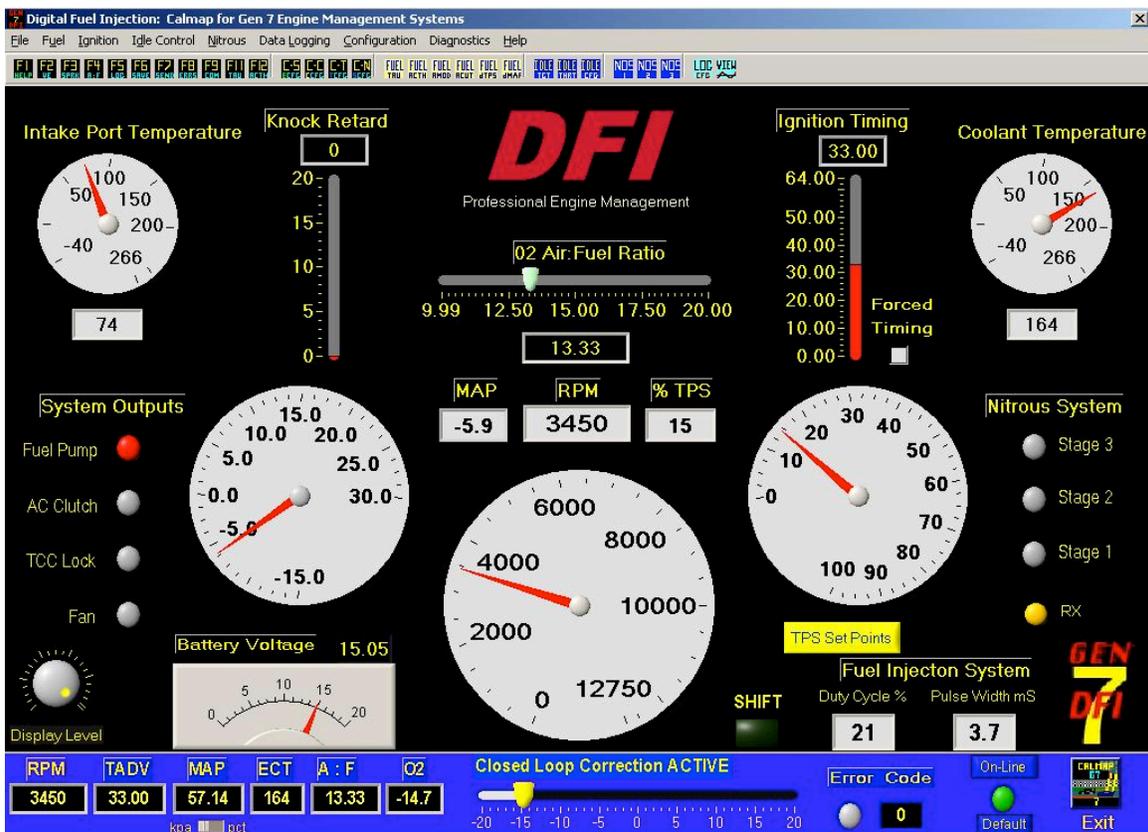


Figure 2: CalMap Instrument Panel, Monitor panel, and Menu Bar.

The CalMap Instrument Panel

Many critical operating parameters of the Engine Control Module are displayed in real-time on the instrument panel while the ECM is powered up, with or without the engine actually running. Engine Speed, Manifold Pressure, Throttle Position, Injector Pulse Width, Injector Duty Cycle, and Ignition Voltage are all displayed graphically and numerically, in easy to read gauges which accurately simulate expensive instrumentation that is normally found in the vehicle. Engine Coolant and Intake Air temperatures are also displayed both graphically and numerically in an easy to read format. Other key parameters that would normally be difficult to display such as HEGO Voltage, O2 Air to Fuel Ratio, Engine Timing, and Knock Retard are shown in quick updating, easy to read bar graphs. Other convenient functions, such as Nitrous Oxide system enable, Cooling Fan, Air Conditioner Clutch Disable, and Torque Converter Lock signal indicators are provided in order to give the user as much information as possible during driving, troubleshooting, and tuning operations. A brightness adjustment knob is provided to change the background color of the white gauges to make them easier to read in the wide variety of light conditions that may be found inside a moving vehicle. The orange indicator labeled 'RX' in the lower right corner of the instrument panel flashes periodically as valid monitor data is received from the ECM to indicate that valid bi-directional communication is present between CalMap and the module.

The CalMap Monitor Panel

The blue strip along the bottom of the CalMap screen consists of a short summary of key operating data from the Instrument Panel, along with critical operating data not displayed on the instrument panel. It is intended to keep the user informed of critical operating information when editing tables, graphs, or ECM operating parameters. It will be visible and active on most of the screens involved in CalMap. The first 5 black boxes on the left side of the Monitor Panel display Engine Speed, Ignition Timing, Manifold Pressure, Engine Coolant Temperature, and Oxygen Sensor values taken from the Instrument Panel. Next is a set of numeric and graphical indicators that display data about the Closed Loop Fuel Feedback system. The 'O2' box displays the Closed Loop Fuel Feedback Coefficient numerically, and the sliding bar graph displays the same data graphically for easy operating point reference while the engine is in operation. Error Code information is displayed both graphically and numerically on the Monitor Panel by an LED which flashes red when an error code has been detected, and a numeric display which shows the first error code generated by the ECM. Viewing and clearing Error codes can be accomplished by clicking on the numeric display with the mouse or pressing CTRL-E to see a list of the active codes. Alternately, all codes can be cleared at any time by pressing the F8 key on the keyboard. Finally, an LED displays the communication status with the ECM graphically and textually. The indicator is red, when the ECM is offline, and green when the ECM is online with CalMap.

Editing Calibration Data with CalMap:

CalMap offers several different methods to change data values in the engine control module. Depending on the size of the data table selected, the data will be displayed in one of several standardized formats. Large tables are displayed numerically with the option to change one, some, or all of the table's values at once. Smaller tables are displayed graphically, and offer a visual representation of the function being edited. Single cell tables are displayed as a sliding control that can be edited numerically, or graphically with both keyboard and mouse control. Configuration data has been grouped into several large screens that offer editing of multiple interrelated parameters at once.

Numerical Table Editing Screens

Large data functions, such as the Base Volumetric Efficiency table shown in Figure 3, are displayed numerically in a spreadsheet-like table format. The horizontal and vertical axes are displayed with their appropriate units, along the left and left side and bottom of the table respectively. Essential information about the data currently being edited and Current operating points are displayed in real time along the right side of the screen. Help for the calibration table being edited is available by pressing the F1 key.

Data values are changed directly by entering a new value in the numeric cell edit box highlighted in blue in Figure 3, and pressing the ENTER key. This cell highlight box can be moved by using the arrow cursor keys on the keyboard or by using the mouse to click in any cell on the table. Data in the cell edit box can be raised or lowered directly by pressing the '[' and ']' keys respectively. The rate of change can be toggled between 1 and 10X by pressing the '\' (Backslash) key.

More than one data value may be changed at a time by highlighting a region of the table. First, cells must be surrounded with the blue border shown on the upper left portion of the table in Figure 3. The border is moved by using the arrow cursor keys to move around the table while at the same time, holding down the SHIFT key on the keyboard. Once the desired cells are surrounded by the blue border, use the P or + keys to add values to the highlighted region, or the * or X keys to multiply the highlighted region by a number.

Global data value assignments may be made by typing a number in the cell edit box while a region of the table is highlighted. For example, highlighting a group of cells, then typing 1.00 and pressing the ENTER key will set all the highlighted values to 1.00.

The current operating point for the engine function being displayed is indicated by a light blue box that floats around the table as the operating point changes. It is located within the highlighted region near the top center of the table in Figure 3. Since the actual operating point may not be located in the exact center of the cell the indicator lies above, there are two Red indicator bars, which help to determine the exact operating, point. The horizontal and vertical Red bar graphs show the approximate point along the axes that the current function is operating around. As the operating point changes, the length of the bar graphs will grow or shrink to indicate the changes. When the operating point of the function falls exactly in the center of a table cell, both the horizontal and vertical bar graphs will disappear.

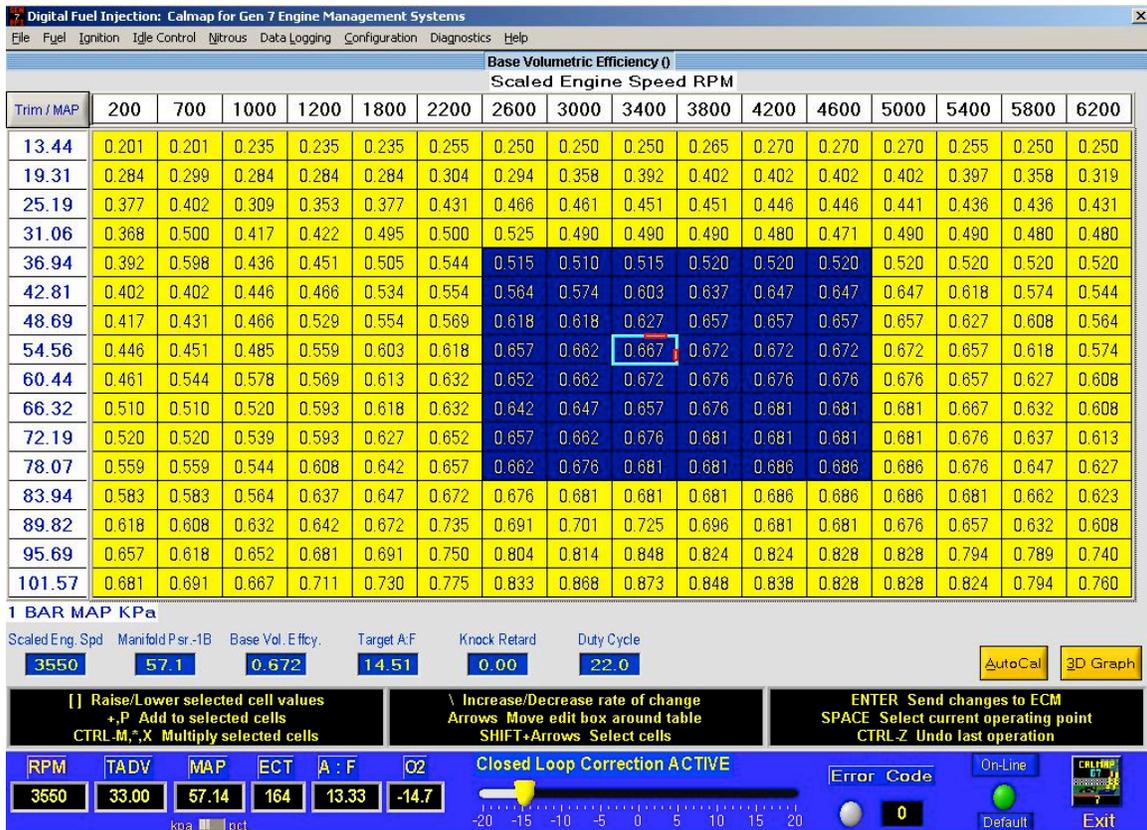
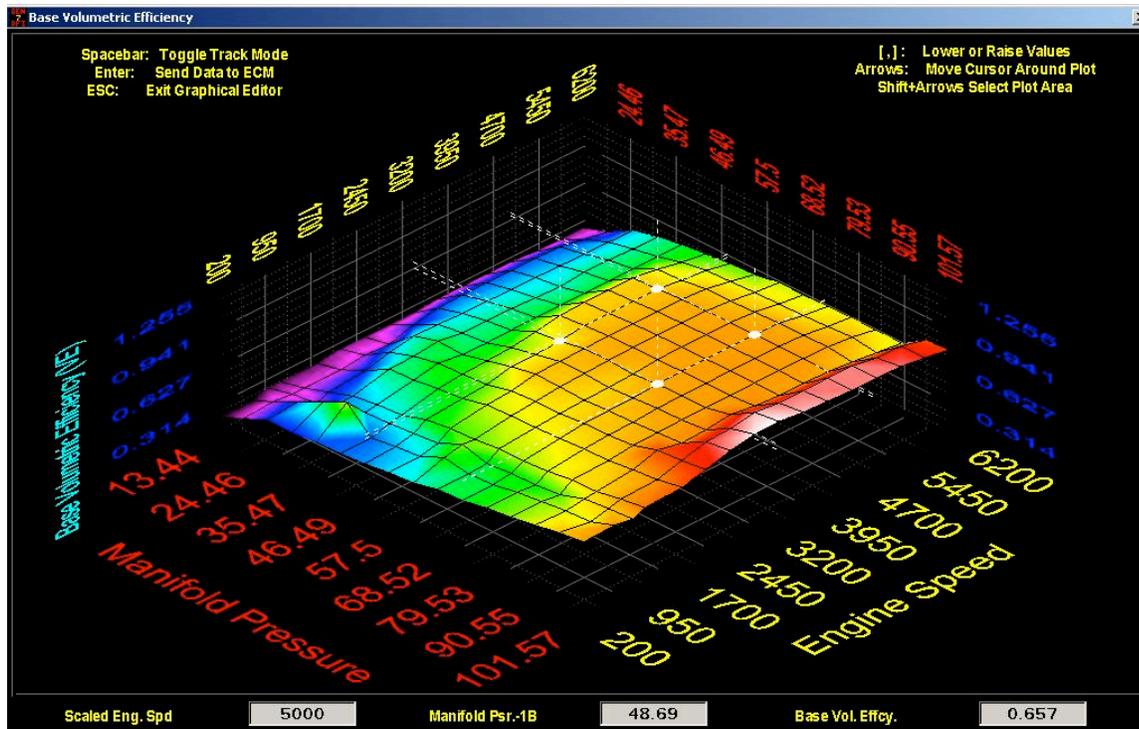


Figure 3: Numerical Table Editing, Base VE Table

Pressing the command button on the lower right side of the screen labeled AutoCal will change the value of the current operating point highlighted in the tracking box by the amount of O2 correction being added by the fuel feedback system. This option is only available when editing the Base Volumetric Efficiency table, and only has an effect when the ECM is actively operating in Closed Loop Fuel Feedback mode.

Pressing the command button on the lower right side of the screen labeled 3D Graph will generate an editable 3 dimensional plot of the data displayed in the numerical table. Various aspects of the plot can be changed by following the on-screen instructions for that graph.



3-Dimensional Graph Editing Screen

Other Numerical Table Editing Screens

Smaller sized tables are displayed and manipulated in much the same way as described for the large numerical tables, with the following exceptions:

- There is no 3D-graph option available for smaller tables.
- The values along the Engine Speed and Manifold Pressure axes cannot be edited.

2-Dimensional (Line Graph) Editing Screen

Many functions in CalMap are displayed graphically as a 2 dimensional line plot in order to make editing the data more intuitive. A typical editable graph plot is displayed in figure 4.

Data is displayed in a line plot with the value being edited displayed on the vertical axis, and the dependent variable for that function being displayed on the horizontal axis. Two lines are actually displayed on each graph, a red one and a black one. The black line represents the original data that resided in the function before it was loaded into the graph. The red line represents the actual data points on the graph. Changes made to the data will be reflected in the position of the red line, while the black line will remain unchanged for use as a reference point.

Essential monitor data associated with the current function being edited is displayed along the bottom edge of the screen. The horizontal and vertical blue lines (crosshairs) indicate the current operating point for the function. Help for the calibration table being edited is available by pressing the F1 key.

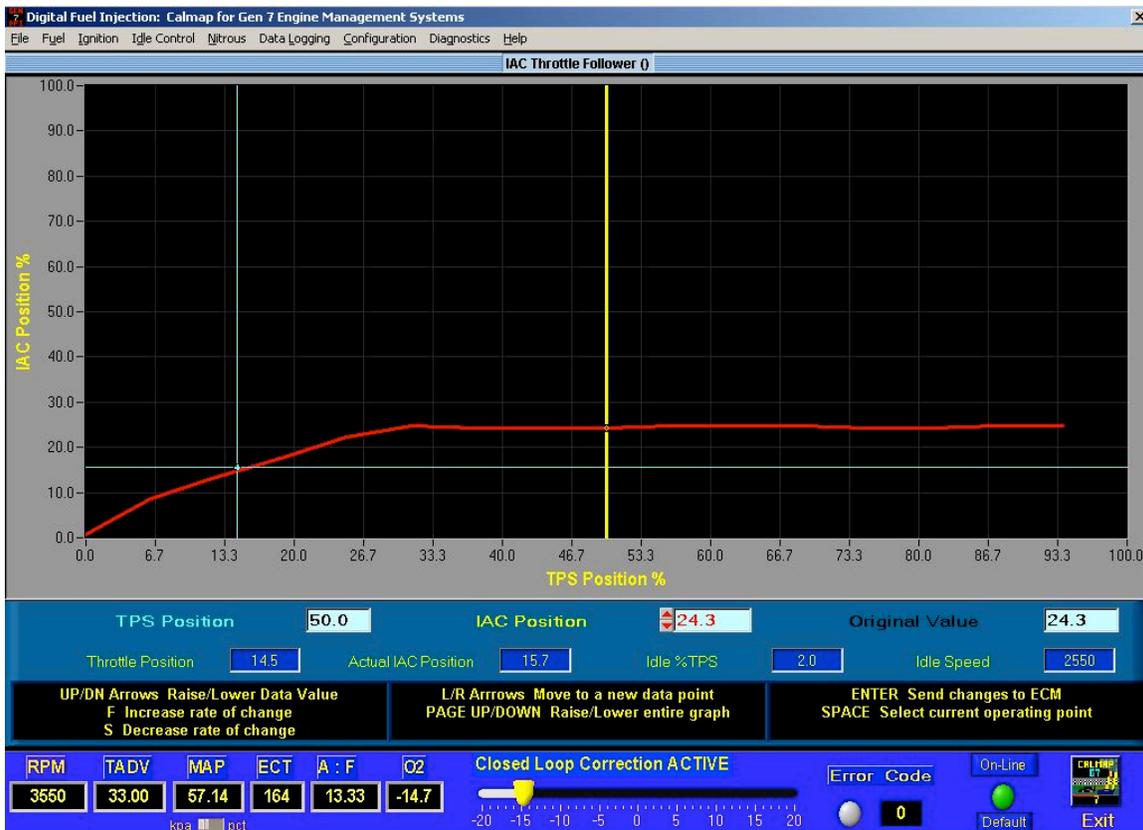


Figure 4: 2-Dimensional Graph Editor

This point will constantly move as the operating point of the function being edited changes.

The bold yellow vertical line indicates the current edit point on the graph. This edit point can be changed either by clicking to a new location with the mouse, or using the Left/Right arrow keys to move in the desired direction along the plot. The values displayed on the graph may be changed in one of several ways:

- Using the mouse, click the desired data point on the plot, and the red line will snap to that point. Press the ENTER key to send the changes to the ECM.
- Using the Up and Down cursor keys, change the data to the new desired values, then press the ENTER key to send the changes to the ECM. Pressing the F (fast) key will make the data value change at a faster incremental rate, and pressing the S (Slow) key will make the data value change at a slower incremental rate.
- Data can be changed numerically by pressing the TAB key until the red edit box along the top of the blue strip under the graph is highlighted. Enter a new numeric value into the box and press the ENTER key to change the data on the graph and in the ECM.
- Using the PAGE UP and PAGE Down keys, the entire plot can be moved vertically up or down.

Single Value Table Editing Screen

Smaller data tables are displayed as single numeric values, which are changed by using the Table Editing Screen, displayed in Figure 5.

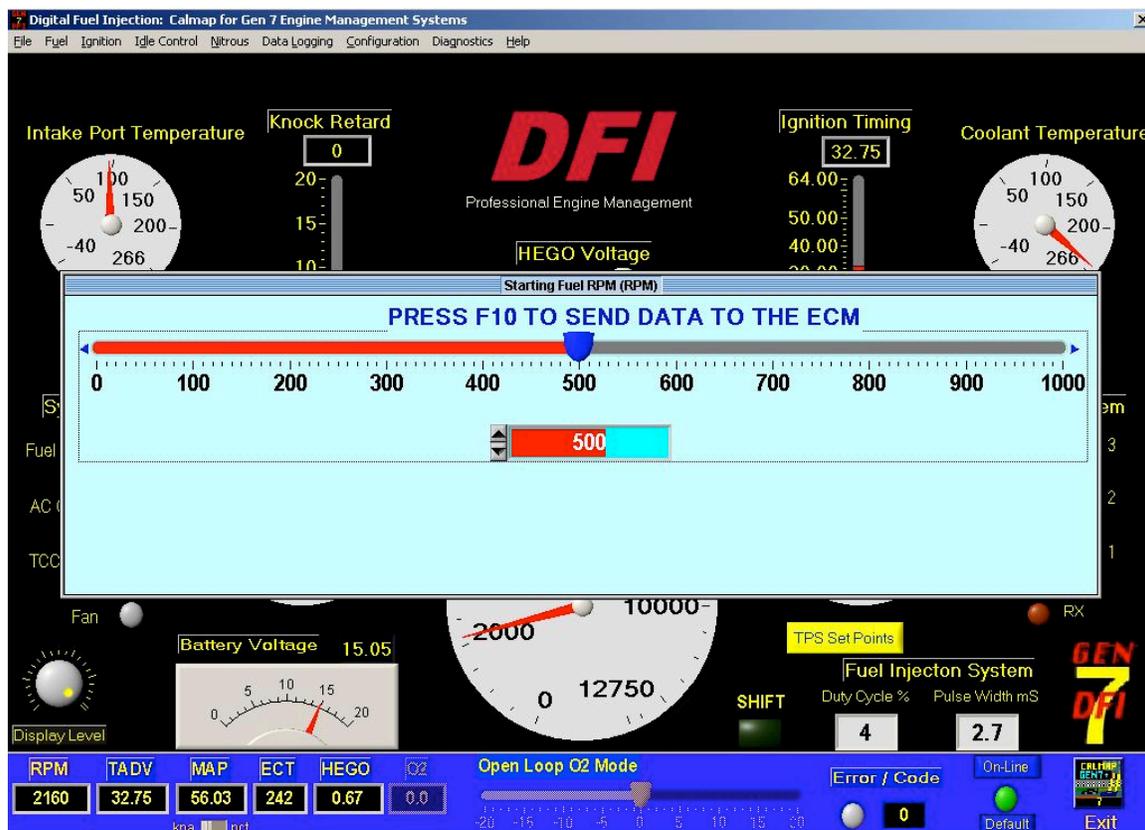


Figure 5: The Single Cell Table Editor Screen

Data values are displayed in a Bar Graph format, and can be changed in one of the following ways:

- Using the mouse, change the sliding data point indicator to the desired position, and then press the F10 key to send the data to the ECM.
- Using the Left and Right arrow cursor keys, change the position of the data indicator to the desired position, then press the F10 key to send the data to the ECM.
- Enter the new data value in the numeric edit box (highlighted in red in Figure 5), press the Enter key, then press the F10 key to send the changes to the ECM.

Essential monitoring data is displayed in real-time along the bottom of the Editor box when appropriate. Help for the calibration table being edited is available by pressing the F1 key.

System Configuration Screen:



Figure 6: The CalMap System Configuration Screen

Using this version of CalMap, it is much easier to configure your ECM to match the parameters of the engine to which it is mated. There are different configuration screens for each area of functionality within the ECM. The System Configuration Screen, displayed in Figure 6, contains data about the basic operating parameters of the system. Engine Displacement, Number of Cylinders, Fuel Injection Strategy, Cam and Crank signal data, and other essential operating settings are contained on a single, easy to understand screen.

Each control parameter can be accessed via both the mouse and the keyboard. After a new value has been entered, press the F10 key to send the individual changes to the ECM. The name of each parameter will flash briefly to a red background to indicate that the data has been successfully transmitted to the ECM. Help for an individual item is accessible by clicking on that item, and pressing the F1 key.

Controls Configuration Screen

Similar to the System Configuration, the Control Configuration Screen sets up the parameters within the ECM related to different control strategies used to constrain the operation of the engine. Ignition and Fueling Rev Limiters, instrumentation setpoints, and

feedback parameters are all controlled from this screen. Navigation and operation of the controls on this screen is identical to that of the System screen.

DFI CalMap Keyboard Command Shortcuts:

Function Keys valid from any screen:

- F1 Activates the CalMap Online Help subsystem.
- F2 Loads the Base Volumetric Efficiency vs. MAP/RPM table.
- F3 Loads the Base Ignition Advance vs. MAP/RPM table.
- F4 Loads the Target Air:Fuel Ratio vs. MAP/RPM table.
- F5 Loads the Data Logging subsystem with the preset 'Autolog' configuration.
- F6 Download a Global Calibration from the ECM and save it to a disk file.
- F7 Upload a Global Calibration file to the ECM from a disk file.
- F8 Clears all the Error Codes in the ECM.
- F9 Attempts to establish communication with the ECM.
- F10 Sends control data to ECM from various configuration/parameter editing screens.
- F11 Loads the Tau vs. MAP/ECT table.
- F12 Loads the Acceleration Threshold editor.

- ESC Closes the current screen or window.
- INSERT Loads the last screen that was opened.
- CTRL-F1 Displays CalMap online drawings and wiring diagrams.
- CTRL-B Loads the Boost Builder configuration screen.
- CTRL-C Loads the ECM Control configuration screen.
- CTRL-D Loads the Input Diagnostics screen.
- CTRL-E Loads the ECM Active Error Code Acknowledge screen.
- CTRL-F Loads the Data Logging Fuel Analysis Subsystem
- CTRL-G Loads the Data Logging Analysis subsystem.
- CTRL-I Loads the Idle configuration screen.
- CTRL-L Loads the Data Logging subsystem with the currently loaded configuration.
- CTRL-N Loads the ECM Sensor Measurement configuration screen.
- CTRL-R Loads the Data Logging Replay subsystem.
- CTRL-S Loads the ECM System Configuration Screen.
- CTRL-V Loads the Engine Parameter Monitor Screen.
- CTRL-X Exits the CalMap Engine Calibration Environment.
- X Multiplies the highlighted cells by a percentage
- + Adds a value to the highlighted cells
- ALT-F Begins navigation in the File menu.
- ALT-U Begins navigation in the Fuel menu.
- ALT-I Begins navigation in the Ignition menu.
- ALT-D Begins navigation in the Idle menu.
- ALT-N Begins navigation in the Nitrous menu.
- ALT-L Begins navigation in the Data Logging menu.

ALT-C Begins navigation in the Configuration menu.
ALT-G Begins navigation in the Diagnostics menu.
ALT-H Begins navigation in the Help menu.

Configuration Screen Shortcut Keys:

TAB Moves control to the next editable field on the screen.
Shift-TAB Moves control to the previous editable field on the screen.
F10 Sends data to the ECM from the Active Edit Control on the screen.
Up/Dn Arrows Change the value of numeric controls, but does not send data to the ECM.
ENTER Activates some controls such as switches, but does not send data to the ECM.

CALMAP TABLE DESCRIPTIONS

FILE MENU

View Table/Graph Data from a file

This option will load a previously saved individual table or graph from a disk file having the suffix .TBL. Data is not immediately sent to the ECM until either the next command in the file menu is used, or some kind of change is made to the data table and sent to the ECM.

Save Current Screen Data to a file

This option will save the entire contents of an individual table or graph screen to a disk file having the suffix .TBL. This command is not valid for configuration screens.

Send Current Screen Data to the ECM

This option will send the entire contents of an individual table or graph screen to the ECM. It is useful after using the previous command to load a table or graph from a disk file. This command is not valid for configuration screens.

Save Global Calibration to a File

This will save the current contents of all the tables and graphs from the ECM into a disk file with the suffix .ECM.

Program Global Calibration from a File

This command will load the all tables and graphs in the ECM from data stored in a disk file with the suffix .ECM.

Edit Global Calibration Comments

This is a table that is intended to contain notes pertaining to the application. The user can enter any text. It is recommended that engine and calibration descriptions be kept here for future reference.

Password Options

This command brings up the CalMap password options edit box. The user password can be entered, modified, and cleared from this screen. Access to Calibration tables can be restricted by programming the Guest Mode Access parameters that are available from the Password Options screen.

If the password for a protected calibration is not available, you may effectively change the password by overwriting the contents of the ECM with a different calibration file. Do this by pressing the F7 key, which will program the ECM with a previously created calibration file. Note that this will change EVERY calibration table, as well as resetting the password for the calibration to that which is contained in the file (if any).

There is no way to 'break into' a protected calibration. The only options you have are to completely erase the entire calibration by replacing it with an unprotected file, or get the password from the person who programmed the original calibration.

Print Current Screen

This will print the current screen using the default printer selected through your operating system.

Close Current Screen

This will close the current CalMap screen, and is equivalent to pressing the ESC key.

Exit

This will leave the monitoring mode of CalMap, and exit to the startup splash screen.

FUEL MENU

FUEL – UTILITIES

VE Table Estimator

This screen will create a starting base fuel map that will, in most cases, be sufficiently accurate to allow the engine to be started and further calibrated. To calculate an estimated base volumetric efficiency table, enter the requested data values on the screen and press the button labeled "Calculate table data". After the table has been generated, you will be taken to the Base VE Editing screen, and can now examine the data. You are prompted as to what to do with the data, and must select from one of the following 3 choices:

1.) **Send data to the ECM.** This option will take the estimated table, in its initial form, and send it to the ECM. The ECM will immediately begin operating off of this table, and modifications to the table can then be made.

2.) **Don't send to ECM.** This option will not send the data to the ECM, but will keep it on the screen for examination. Caution must be exercised when selecting this option, as the data that remains on the screen is not the same as the actual Base VE table that is stored in the ECM. Note that any modifications that are made to this data will immediately be sent to the ECM. The entire table can be sent to the ECM by using the "File->Send Current Screen Data to ECM" menu option.

3.) **Discard this data.** This option will close the VE predictor screen and discard the estimated table that was generated. No changes will be sent to the ECM.

Pulse Width Estimator

The values in the Estimated Pulse Width table are reflective of the actual fuel injector pulse width values that will be calculated and commanded by your DFI Gen 7+ ECM. These values are mathematical estimates of what the actual injector pulse width values will be under varying load and engine speed conditions. Values are displayed for the appropriate injection strategy that you have selected within your calibration: either Sequential or Staggered Batch. Using the slider bar on the bottom right side of the screen, you can display Pulse Width, Duty Cycle, or even an estimate of what the same fuel map would look like in a DFI Generation 6 ECM. Values are in milliseconds, and may be edited using the keyboard. Use the numeric keys to enter a new pulse width value, then press the ENTER key to send that value to the ECM. Alternately, you may use the bracket keys, [and], to increment or decrement the table values. When editing values, the number will be displayed in red if the calculated duty cycle for that cell is above 95%, approaching a static condition. Numbers will be displayed in blue for pulse width values that will cause a volumetric efficiency value greater than the range of your fuel table. In this case, you can use the Fuel Trim function in the VE table to extend the range of your volumetric efficiency table as needed. Click on the fuel trim button in the upper left hand corner of your matrix VE table to display the coefficient. The fuel trim is adjustable in every MAP row. Range is; 0.75 or 25% less fuel to 1.75 or 75% more fuel. 1.00 is considered nominal or 0% adjustment. Select Auto at the switch at the bottom of the fuel matrix to automatically rewrite the VE table when a value is entered. This will raise or lower the ceiling of the VE numbers without affecting the actual fuel output. In manual mode, the VE numbers don't change, however the fueling to the motor is directly effected by the coefficient. Raising or lowering the fueling by a given percentage.

NOTE: The values in the Pulse Width Estimator are ESTIMATED! It is not recommended that this table be used for tuning an engine, it is offered as a reference only. It may be used as a tool to help convert a known fuel table from an older system for use with your DFI Gen 7+ Engine Management System. You may also use it as an aid in determining

the appropriate size of fuel injector that your engine application will require.

FUEL – STARTING

After-Start Fuel Coefficient vs Engine Coolant Temperature

The values in this table specify the amount of fuel adjustment for initial engine running conditions. Engine coolant temperature is used to select an adjustment value to be applied to the fuel delivery. The normal amount of fuel that the ECM calculates is multiplied by the value from this table before being delivered to the engine. This table serves to compensate for a variety of phenomena that occur when an engine is first started (e.g. poor fuel atomization when cold, fuel vapor when hot, loose piston clearance when cold, etc.). This adjusting coefficient is decayed out after the engine runs for some period of time. Refer also to After-Start Decay tables.

Index: Engine coolant temperature

Range: 0.5 to 1.5

Units: None (Coefficient)

Resolution: 0.00392

Base After-Start Decay

The values in this table specify the rate at which the initial After-Start fuel adjusting coefficient is decayed out. Engine speed and manifold absolute pressure are used to select the values from this table. The table value is the number of camshaft rotations between After-Start decay steps. Each decay step is 0.39%. If the After-Start adjusting coefficient is less than 1.0 it will be increased until it reaches 1.0 and then it will stop. If the After-Start adjusting coefficient is greater than 1.0 it will be reduced to 1.0 and then stop. Once the adjusting coefficient is 1.0 it will no longer affect the fuel delivered to the engine. See also the After-Start Fuel Decay Modifier vs. Engine Coolant Temperature table.

X Index: Engine Speed, Base Ve Table RPM Scale

Y Index: Manifold absolute pressure

Range: 1 to 255

Units: Camshaft rotations between decay steps

Resolution: 1.0

After-Start Fuel Decay Modifier vs Engine Coolant Temperature (Pro Version only)

The values in this table specify an adjustment to the rate that the After-Start fuel coefficient is decayed out. Engine coolant temperature is used to select the value used from the table. The number of camshaft rotations between After-Start decay steps is multiplied by the value from this table to yield the actual number of camshaft rotations between decay steps. Generally a cold engine requires a longer duration of After-Start

then a hot engine, hence table values in the cold range of this table are larger than the hot portion of the table.

Index: Engine coolant temperature

Range: 0.0 to 1.0

Units: None (Coefficient)

Resolution: 0.00392

Prestart Fuel

Pre-starting fuel is the amount of fuel that is injected into the engine while it is cranking. Adjust this table as needed to help your vehicle start consistently in varying weather conditions.

Index: Engine Coolant Temperature

Range: 0-100% of Possible Fuel Mass

Units: Percent

Starting Fuel Coefficient

This table contains correction values that are applied to the fuel delivery during engine starting. Engine coolant temperature is used to select the correction value from this table. When the engine is first cranked to start the normal amount of fuel is multiplied by the value selected from this table. The fuel decays out after initial starting. Refer also to the After-Start Fuel Coe. Table. Generally colder engines need more fuel to start than when hot.

Index: Engine coolant temperature

Range: 0.5 to 1.5

Units: None, Coefficient

Resolution: 0.00392

Starting Fuel RPM

The Starting Fuel RPM is the engine speed that must be attained in order for the engine to be considered running. Once this threshold has been reached, the ECM shifts its fueling strategy control over to the afterstart tables.

Index: Engine Speed

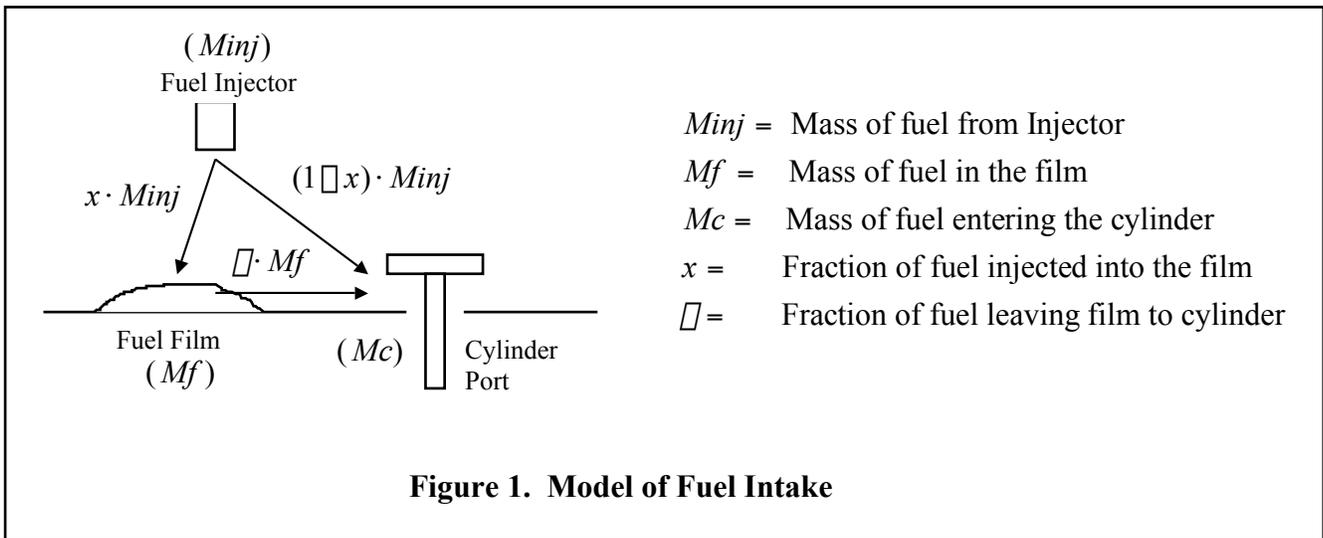
Range: 0 - 2500

Units: RPM

FUEL – TRANSIENT

Tau vs.MAP/ECT and X vs.MAP model

The ECM employs a fueling strategy that models the actual flow of fuel in an engine. The model is often times referred to as the Tau-X model. Its Greek letter usually represents tau - τ . Figure 1 illustrates the basic concept.



- $Minj$ = Mass of fuel from Injector
- Mf = Mass of fuel in the film
- Mc = Mass of fuel entering the cylinder
- x = Fraction of fuel injected into the film
- τ = Fraction of fuel leaving film to cylinder

The model describes the fuel behavior in the intake manifold. The process of delivering fuel to an engine's cylinder is that first the fuel leaves the injector. Some of the injected fuel, X-amount, is deposited on the surfaces surrounding the intake valve. The rest of the injected fuel, (1-X)-amount, is pulled into the intake valve. When the intake valve opens it also pulls in some part of the fuel that has been deposited on the surrounding surfaces, τ amount.

Both X and τ are fractions. That is, a value of 1 means all of the fuel. A value of 0.5, for example, would mean only $\frac{1}{2}$ of the fuel. As an illustration, if $X=0.8$ and $\tau=0.2$ then $\frac{8}{10}$ ths of the fuel leaving the injector would be deposited on the surrounding surface. $\frac{2}{10}$ ths of the injected fuel would go directly into the intake valve. An additional amount of fuel would also go into the intake valve from the film deposited on the surface. In this case $\frac{2}{10}$ ths of the film would be pulled into the cylinder.

To further illustrate the idea and bring forward an understanding of the dynamics of fuel flow in a fuel injected engine the case of a sudden injector pulse-width change on an engine is presented. If $X=0.6$ and $\tau=0.2$ and 12 milliseconds of injected fuel is laying on the walls from past injects then, when the injector pulse-width changes from 5 to 20 milliseconds, the following series of calculations shows the actual fuel ingested into the cylinder at each intake valve opening.

Usually there is a delay from the time that the fuel injector changes flow to the time that the cylinder actually receives the same amount of flow. Also note that the amount of film

on the wall increases as injector flow increases. The strategy in the ECM takes all of this into account when controlling the injector pulse width. In order to achieve correct transient response fueling it is important that the τ and X values be calibrated to match the engine.

In layman's terms, Tau and X would correspond to the fuel accelerator pump cam function in a carbureted application.

Tau vs. MAP/ECT

X Index: engine coolant temperature
Y Index: Manifold absolute pressure
Range: 0 to 100
Units: %
Resolution: 0.392

Acceleration Threshold

When the engine requires a change in instantaneous fueling, the ECM will calculate an asynchronous fueling value based upon various table inputs. This mass fuel value is scaled to 0 to 100 mass units. 0 represents the maximum amount of asynchronous fuel that can be injected into the engine, and 100 represents the least amount injected. For example, if the table had a value of 15 units and the ECM requests 20 units, then ECM would ignore the request for the first 15 mass fuel units thereby injecting only the remaining 5 units. The function of this table is to disregard very small requests for fuel, primarily caused by minute changes in MAP. Generally, cam overlap plays a large roll in MAP fluctuations. So the higher the overlap, or the hotter the cam, the higher the number that should be entered. A value of 10 to 20 would be a good starting point.

Range: 0 to 100
Units: Fuel Mass
Resolution: 0.392

Acceleration Modifier

The value in this table specifies the amount of adjustment to be applied to the acceleration fueling as a function of Engine Coolant Temperature. This coefficient modifier is multiplied by the additive, fuel mass to achieve a new asynchronous fuel amount. A value of 1.0 is recommended as a starting point. The Acceleration Modifier is a secondary trim table for adjusting asynchronous fueling. Refer to the Tau and X tables for initial acceleration and deceleration fuel requirements. In layman's terms, this corresponds to the accelerator pump volume function in a carbureted application.

Range: 0.5 to 3.5
Units: None (Coefficient)
Resolution: 0.117

Acceleration Modifier Mask

The values in this table offer a way to mask out unneeded application of the Acceleration Modifier Coefficient calibration table. The values from the Acceleration Modifier table are multiplied by the values in the Acceleration Modifier Mask table to determine a final number for the Acceleration Modifier value as it is used in fuel calculations. Values in this table may range from 0.0 to 1.0, with 0 allowing no acceleration fuel modification, and 1.0 allowing full acceleration fuel modification.

Range: 0 to 1.0

Units: None (Coefficient)

Acceleration Cutoff

This table contains a value, in MAP(%). When the manifold absolute pressure exceeds this value, no further asynchronous fueling is injected into the motor. The purpose of this table is to prevent any asynchronous fueling during small changes in manifold pressure.

Range: 0 to 100

Units: None (Coefficient)

Resolution: 0.39

TPS Rate of Change Acceleration Enrichment

This table selects the amount of asynchronous fuel that is added to the current fuel control strategy based on instantaneous changes in the throttle position sensor reading. *The table value for a rate of change equal to 0 must always be equal to 0.*

Range: 0 to 127.5

Units: Fuel, Pounds Per Hour

Resolution: 0.5

TPS Rate Of Change Acceleration Enrichment Modifier

This table is used to prevent the occurrence of TPS-based acceleration fueling in certain operating regions of the engine. Table values are a multiplier of the values derived from the TPS Rate of Change Acceleration Enrichment table. A table value of 1.0 will allow the full range of TPS-based acceleration enrichment at the given operating point of the engine. A table value of 0.5 will only allow _ of the full range of TPS-based enrichment. Table values may range from 0.0 to 1.0, with a value of 0.0 allowing no TPS-based enrichment at the given operating point.

Range: 0 to 1.0

Units: None (Coefficient)

MAP Rate Of Change Acceleration Enrichment

This table contains a value, in MAP(%). When the manifold absolute pressure exceeds

this value, no further asynchronous fueling is injected into the motor. The purpose of this table is to prevent any asynchronous fueling during small changes in manifold pressure. *The table value for a rate of change equal to 0 must always be equal to 0.*

Range: 0 to 100

Units: None (Coefficient)

Resolution: 0.39

FUEL – STEADY STATE

Cylinder #1 - #8 Individual Cylinder Fuel Correction Coefficients

The values in these tables specify a fuel adjustment for each of the cylinders. The tables are only used when the ECM is configured for sequential fuel injection. Engine speed and manifold absolute pressure are used to select the adjustment value for each cylinder. The fuel delivered to each cylinder is the normally calculated fuel times the associated cylinder's adjusting value.

X Index: Engine Speed, Base VE Table RPM Scale

Y Index: Manifold absolute pressure

Range: 0.5 to 1.5

Units: None (Coefficient)

Resolution: 0.00392

Injector Correction vs. Voltage (Pro Version only)

The values in this table specify an amount of adjustment to be applied to the fuel injector pulse to compensate for the system voltage. The voltage measured by the switched ignition signal to the ECM is used to select an amount of time to add to the injector pulse. Generally as the voltage decreases the amount of injector correction increases. Voltages over 12.0 V usually do not require any additional injector time. The amount of correction is dependent on the injector type and manufacturer.

Index: Switched ignition voltage

Range: 0.0 to 2.04

Units: milliseconds

Resolution: 0.008

Base Offset Injector timing (Sequential Injection Only)

This value, displayed in crank angle degrees, specifies the offset point that the Injector Target timing table indexes. This value generally would be the intake valve closing angle, in crank degrees. In order to set this value, obtain the Camshaft Information Card for your engine. As an example, we will use the ACCEL 74219 camshaft for a small block Chevrolet V8. Locate the angle at 0.050 tappet lift at which the intake valve closes. This is usually read in crank degrees, (ABDC) after bottom dead center. Since the cam card

shows the intake valve closing point at 41°ABDC, and we know the crank angle at BDC intake stroke is 540° on a Chevrolet V8, then we can calculate the exact angle in crank degrees at which the intake valve closes. Simply combine these figures, 41° and 540° to net a crank angle intake closing timing of 581° @ 0.050" valve lift. Enter 581 in the table. The ECM will round this value to the nearest factor of 10, so the ECM will display 580.

Range: 0 to 720

Units: crank angle degrees

Resolution: 10

Target Injector timing (Sequential Injection Only)

This table contains fuel injector target timing values for all possible engine speeds and engine loads. This value, displayed in crank angle degrees, designates the end of inject point of the fuel injector. In order to set this value accurately, obtain the Camshaft Information Card for your engine. As an example, we will use the ACCEL 74219 camshaft for a small block Chevrolet V8. Locate the intake valve duration at 0.050 tappet lift. The value, 218°, should be used as the base target timing index throughout 4x4 table. Using this target timing we are assured that the injection event will not coincide with the intake valve opening event. Typically, end of inject point should occur before the intake valve opens. Under light load conditions, if the intake valve is open during an inject cycle, poor atomization, or improper mixing of fuel will occur. This could cause driveability and exhaust emission related problems that can not be tuned out by the operator. To promote better atomization of the fuel, you would normally lead this opening event by 90° or more. This 'lead' time would depend on the distance of the injector to the valve, the size of the injector, the RPM range of the motor, the physical angle in which the injector is mounted to the manifold, and emission restrictions. For this example, we will lead the event by 90°, assuming we are using an ACCEL SuperRam manifold. This manifold utilizes 30#/hr injectors, located in close proximity to the intake valve. Take this lead time angle, 90°, add it to the original target timing value of 218° to obtain the new target timing of 308°. Enter 308 in the table. The ECM will round this value to the nearest factor of 10, so the ECM will display 310. The End of inject timing is calculated by the ECM as, Injector Base Offset Timing minus Injector Target timing. In this case the value is (580° - 310°) or 270 crank degrees.

Range: 0 to 720

Units: crank angle degrees

Resolution: 10

Target Air to Fuel ratio

This table contains values of target air to fuel ratios for all possible speeds and manifold pressures. The strategy in the ECM calculates fuel delivery based upon the settings in this and other tables.

The calculation performed in the ECM for fuel delivery is basically:

Fuel to Engine = Measured Air In / Target Air to Fuel Ratio

Air into the engine is based upon the manifold pressure, port air temperature and volumetric efficiency. When intake port temperature is measured accurately and volumetric efficiency is calibrated properly then the entries in this table will match the actual fuel to air mixture delivered to the engine.

The values in this table are also used for closed loop fuel control. Closed loop fuel control is when the ECM adjusts fuel delivery based upon the signal it receives from the exhaust oxygen sensor. The standard exhaust sensor used is a Heated Exhaust Gas Oxygen sensor (HEGO). This sensor switches from approximately 0.1 volts to 0.9 volts at the stoichiometric air to fuel ratio (for gasoline this is approximately 14.5 to 1. Linear exhaust sensors, with associated signal conditioning circuitry, are available that supply a signal that is proportional to air to fuel ratio. These sensors are typically referred to as Linear, or Wideband, or UEGO (Universal Exhaust Gas Oxygen) sensors.

When the ECM operates in the open loop fuel mode fuel delivered to the engine is a direct result of the above calculation. When in closed loop fuel mode the fuel delivery is the result of the above calculation multiplied by a correction value that is derived from the signal of the exhaust sensor. Refer to the various closed loop fuel control calibration tables for description of the fuel response to the exhaust sensor signal.

X Index: Engine Speed, Base VE Table RPM Scale

Y Index: Manifold absolute pressure

Range: 10 to 20

Units: ratio, air to fuel

Resolution: 0.00784

VE Correction vs. Target Air to Fuel Ratio (Pro Version only)

This table contains values that specify how the volumetric efficiency is affected by the richness of the air/fuel mixture. The target air to fuel mixture is used to select a correction amount from this table. The correction is applied to the base volumetric efficiency. Usually as the air/fuel mixture becomes richer (lower air to fuel ratio) the volumetric efficiency of the engine decreases. Essentially the air pumping capability of the engine is reduced because the additional fuel increases intake mass. The additional mass is more difficult for the engine to pull through.

Index: Target air to fuel ratio

Range: 0.5 to 1.5

Units: None (Coefficient)

Resolution: 0.00392

VE Correction Coefficient vs Estimated Intake Port Temperature (Pro Version only)

This table contains values that specify an amount of correction to be applied to the base volumetric efficiency value. The intake port temperature is used to select the correction value from this table. The base volumetric efficiency is multiplied by this value, as well as

other correcting values, to produce the final volumetric efficiency value that is used for calculating the amount of air entering the engine.

As the temperature of the air entering the engine increases the volumetric efficiency increases. Usually the values in this table increase with intake port temperature. This correction should not be confused with air density change over temperature. While higher air temperatures reduce air density, hence less mass of air, the reduced density makes it easier for the engine to pump it through.

Note also that the estimated intake port temperature is used to select this correction not the intake air temperature sensor reading. The temperature of the air and fuel mixture entering the cylinder is not necessarily the temperature of the temperature at the intake air temperature sensor. Refer to the intake port temperature estimating calibration tables for more detail.

Index: Estimated intake port temperature

Range: 0.5 to 1.5

Units: None (Coefficient)

Resolution: 0.00392

VE Correction vs Engine Coolant Temperature (Warm-up Map)

This table contains values that specify an amount of correction to be applied to the base volumetric efficiency value. The engine coolant temperature is used to select the correction value from this table. The base volumetric efficiency is multiplied by this value, as well as other correcting values, to produce the final volumetric efficiency value that is used for calculating the amount of air entering the engine.

As the temperature of the engine increases the volumetric efficiency decreases. Usually the values in this table decrease with increasing engine temperature. This correction should not be confused with start-up fuel corrections. Start-up corrections are used to compensate for initial conditions and driveability not steady state pumping characteristics. Note also that the correction value from this table is multiplied by a compensating coefficient based on engine speed and manifold pressure. The actual amount of volumetric efficiency compensation for engine temperature is the combination of this table's value and the value from the ECT VE correction compensation vs MAP/RPM table. By combining the corrections from the two tables effects of engine friction and air velocity can be captured.

Index: Engine coolant temperature

Range: 0.5 to 1.5

Units: None (Coefficient)

Resolution: 0.00392

ECT VE Correction vs MAP/RPM (Pro Version only)

The values in this table specify an amount of correction to be applied to the volumetric efficiency compensating value for engine coolant temperature. Engine speed and manifold pressure are used to select a value from this table. The base volumetric efficiency correction value for engine coolant temperature is multiplied by the value from this table to yield the total actual correction to the volumetric efficiency for engine temperature.

Generally, as engine speed and load increases the effects on volumetric efficiency from engine temperature decrease. The values in this table are usually near 1.0 at low speeds and manifold pressures and closer to 0.0 at high speeds and high manifold pressures.

X Index: Engine Speed, Base VE Table RPM Scale

Y Index: Manifold absolute pressure

Range: 0.0 to 1.0

Units: None (Coefficient)

Resolution: 0.00392

Base Volumetric Efficiency (Fuel Map)

The values in this table specify the air pumping efficiency of the engine at all of its' speeds and loads. The engine pumping efficiency is called the volumetric efficiency. It is a measure of how well the engine can pump air through it. Basically it is the ratio of the volume of the available air passing through the engine to the displacement volume of the engine. Engine speed and manifold pressure are used to select the volumetric efficiency at any given speed and load.

This table contains base VE values. The value that is used from this table for any given speed and load is then corrected for a number of other factors (e.g. intake port temperature, engine coolant temperature, etc.). Note also that the ECM uses the values in this table to calculate the mass of air actually entering the engines' cylinders. The ECM calculates the actual fuel to be delivered to the engine by:

Mass of Fuel = Target Air:Fuel Ratio / Mass of Air entering the engine

Either modifying the target air to fuel ratio table or the base VE table will change engine fueling. In order to truly model engine operation, generate an accurate calibration, The air and fuel must be treated separately. The VE table should be adjusted to produce air to fuel ratio values that match the target air to fuel ratio table values. Once the volumetric efficiency is calibrated then the ECM will be able to accurately measure air mass from the air mass then it can calculate the proper amount of fuel to deliver. When volumetric efficiency is calibrated properly then whatever is entered into the target air to fuel ratio table will be the actual air to fuel mixture in the engine.

At operating points near engine peak torque VE's are generally highest. At high intake manifold vacuums VE's are usually smallest.

X Index: Engine Speed, Base VE Table RPM Scale

Y Index: Manifold absolute pressure

Range: 0.25 to 1.25

Units: None (Ratio)

Resolution: 0.00392

Alpha-N MAP vs Percent Throttle

In Alpha-N mode, the VE table is based on Throttle Position vs. RPM. This mode is recommended only when tuning race engines with extremely low or erratic idle vacuum. The values in this table specify an estimated manifold absolute pressure for a given

throttle position. When the ECM is configured for Alpha-N operation the signal from the throttle position sensor is converted into a percentage of full throttle. The percentage of throttle is then used to select an estimate of the manifold pressure from this table. The ECM then treats the estimated manifold pressure as it would if it were actually reading it from a MAP sensor. All of the calibration tables and calculations in the ECM will use the estimated manifold pressure in the place of the real pressure when configured for Alpha-N operation.

Index: % of throttle

Range: 0 to 100

Units: % MAP

Resolution: 0.373

ECT – IAT Difference (Pro Version only)

This table contains coefficients that are used to estimate the intake port temperature. The coefficients are looked up from a table that is based upon intake mass airflow. For a given mass airflow a corresponding coefficient is retrieved from this table. The coefficient is then applied to the calculation:

$$IPT = ECT - IAT \text{ Coef} \times (ECT - IAT) - MST \text{ Coef} \times (ECT - MST)$$

Where:

IPT = Estimated Intake Port Temperature

ECT = Engine Coolant Temperature

MST = Manifold Surface Temperature

The purpose of this table is to capture the effects of the various heat flow elements in the intake manifold. Sensing of the intake air at a point that is not near to where the fuel and air mix can potentially cause substantial errors in the calculation of air density. Air density is proportional to air temperature.

The cylinder head temperature is at near the coolant temperature and the temperature of the air at the throttle body is at near outside ambient temperature. The temperature at the port, where the air and fuel mix, is something in between. In the case of small airflow's (i.e. idle) the incoming air picks up much of the heat from the cylinder head while at high airflow rates the outside temperature dominates.

As the values in the table increase the measurement of intake port air temperature is more influenced by the intake air temperature sensor reading.

Range: 0 to 1.0

Units: None

Resolution: 0.0392

MST – IAT Difference (Pro Version only)

This table contains coefficients that are used to estimate the intake port temperature. The coefficients are looked up from a table that is based upon intake mass airflow. For a given mass airflow a corresponding coefficient is retrieved from this table. The coefficient is then applied to the calculation:

$$IPT = ECT - IAT \text{ Coef} \times (ECT - IAT) - MST \text{ Coef} \times (ECT - MST)$$

Where:

IPT = Estimated Intake Port Temperature

ECT = Engine Coolant Temperature

MST = Manifold Surface Temperature

The purpose of this table is to capture the effects of the various heat flow elements in the intake manifold. Sensing of the intake air at a point that is not near to where the fuel and air mix can potentially cause substantial errors in the calculation of air density. Air density is proportional to air temperature.

The cylinder head temperature is at near the coolant temperature and the intake manifold surface temperature that surrounds the incoming air is at near the under hood temperature. The temperature at the port, where the air and fuel mix, is something in between. In the case of small airflow's (i.e. idle) the incoming air picks up much of the heat from the cylinder head while at high airflow rates the incoming air from the throttle dominates.

As the values in the table increase the measurement of intake port air temperature is more influenced by the manifold surface temperature sensor reading.

Range: 0 to 1.0

Units: None

Resolution: 0.0392

FUEL – FEEDBACK

Fuel Control Proportional Gain

This is the value placed on the O2 correction control that amplifies the error to drive the position towards the desired response. If set too high, the proportional gain can produce excessive amounts of overshoot and oscillation. To a degree, it can reduce but not eliminate steady state error. Generally, the proportional gain will be low at low mass air flow values, such as idle, escalating to an increased value with high mass air flow numbers. This table allows the end user to calibrate the desired weight applied to closed loop error at low and high engine air flow rates.

Range: 0 to 100

Units: None (Coefficient)

Resolution: 0.0392

Fuel Control Integral Gain

This is the value placed on the O2 correction control that acts on the history of the error, balancing the positive and negative portions of the response. Typically, small integral gains produce gradual changes that are used to avoid destabilizing the closed loop system. On the other hand, high gains achieve a faster response with decreased stability. If set accurately, this control can eliminate steady state error. This table allows the end

user to calibrate the preferred relatively, stable, and slow response at idle, and the preferred stable, fast responses while at higher engine airflows.

Range: 0 to 100

Units: None (Coefficient)

Resolution: 0.0392

Fuel Control Differential Gain

This is the value placed on the O2 correction control that reacts to the slope of the error, thereby minimizing overshoot. It provides rate feedback that results in more dampening. High differential gains can increase rise time, settling time, and instability during steady state feedback. This table allows the end user to calibrate the desired dampened error response at idle, and as well as, high engine air flows.

Range: 0 to 100

Units: None (Coefficient)

Resolution: 0.0392

HEGO/UEGO Feedback Delay

The value in this table impacts the sample rate of the Exhaust Gas Oxygen Sensor input. Use this table like a low-pass filter to diminish the magnitude of responses to small changes on the oxygen sensor input signal, which smoothens the response of the fuel feedback system.

Range: 0 to 4080

Units: milliseconds (1/1000th of a second)

UEGO Maximum Fuel Feedback Coefficient

This table contains values that determine the limits of fuel correction when operating in the closed loop fuel control mode. The index is the limit of the amount of fuel correction vs. engine load and RPM that the ECM will provide when it is in closed loop. The limit is both plus and minus. That is, if the limit is 10% then the closed loop fuel control coefficient will be allowed to change between 0.90 and 1.10. If the coefficient is 1.0 then the correction is 0%. In some cases, the application might call for open loop status under extreme conditions. This can be accomplished by entering 0 percent at that given speed and load value.

This table only applies when the ECM is configured for the Wide Band, or Universal Exhaust Gas Oxygen (UEGO) type sensor. The UEGO sensor is for the most part a linear sensor. Sensor input comes from a conditioning module. This module sends information to the ECU that can correlate the information into an air to fuel ratio. When the mixture in the exhaust is leaner or richer than the designated target air to fuel ratio, then the ECM will correct the fueling requirements up to the specified limit set in this table.

Range: 0 to 25

Units: Percent

Resolution: 0.196

HEGO Maximum Fuel Feedback Coefficient

This Table contains values that specify the limits of fuel correction vs mass air flow when operating in the closed loop fuel control mode. The value selected is the limit of the amount of fuel correction that the ECM will provide when it is closed loop. The limit is both plus and minus. That is, if the limit is 10% then the closed loop fuel control coefficient will be allowed to change between 0.90 and 1.10. In some cases, the application might call for open loop status under extreme conditions. This can be accomplished by entering 0 percent at that given mass airflow value or by setting the target ratio table to a value other than the stoichiometric ratio. Refer to the HEGO Modifier for further corrections.

This table only applies when the ECM is configured for the Heated Exhaust Gas Oxygen (HEGO) type sensor. The HEGO sensor is for the most part a digital type sensor. It's output voltage at the stoichiometric air-to-fuel ratio is typically 0.45 volts. When the mixture in the exhaust is leaner than the stoichiometric ratio, then the sensor signal output voltage is below 0.45V. When the mixture is richer than the stoichiometric ratio, then the sensor output signal voltage is above 0.45V. The Stoichiometric ratio is the air to fuel ratio that results in the most complete combustion of the fuel. For gasoline this is about 14.5 parts of air to 1 part of fuel.

Range: 0 to 25

Units: Percent

Resolution: 0.196

HEGO Stoichiometric Air to Fuel Ratio (Pro Version only)

The Stoichiometric ratio is the air to fuel ratio that results in the most complete combustion of the fuel. For gasoline this is about 14.5 parts of air to 1 part of fuel. This must be set to 14.5 when running gasoline.

Range: 10 to 20

Units: Air to Fuel mixture ratio

Resolution: 0.0784

Closed Loop ECT Threshold

This table is designed to prevent closed loop correction under engine warmup conditions. The value in this table specifies the engine coolant temperature the engine must exceed before beginning closed loop fueling correction. The ECU must also satisfy the parameter in the Closed Loop Delay vs. starting ECT table before commencing closed loop corrections.

Range: -40 to 266

Units: Engine Coolant Temperature (*F)

Resolution: 1.2

Closed Loop Delay vs. Starting ECT

This table was designed to allow the oxygen sensor ample time to warm up to prevent erroneous O2 feedback corrections. The value in this table specifies the delay time in seconds the engine must run before beginning closed loop fueling correction. This delay time in seconds is factored as a function of the engine coolant temperature at startup. Refer to the closed loop ECT threshold for the other closed loop parameter. The recommended *minimum* time for a HEGO sensor would be approximately 420-600 seconds on a cold engine to 180-300 seconds for a warm engine. A UEGO or wide band sensor typically would require less time, about 180-360 seconds for a cold engine and 60-180 seconds for a hot engine.

Range: 0 to 1275

Units: seconds

Resolution: 5

IGNITION MENU

IGNITION – STARTING

Ignition Start-up Term

The values in this table specify a base amount of ignition advance to be added to the base ignition advance during initial engine starting. The engine coolant temperature serves as a pointer into this table. The pointer selects an amount of ignition advance to be added to the base advance during or shortly after the engine is started. The actual ignition advance angle during start-up proceeds through two phases, phase-in and decay-out.

When the engine is initially cranked while starting, timing is set to 0 degrees BTDC. As the engine begins to run the advance delivered to the engine increases at a rate specified by the Ignition Start-up Phase-in Interval table. Once the advance reaches the total amount specified by the sum of all of the values of the contributing tables (Including Start-up Advance) the Start-up advance term then begins to decay out. The start-up advance term is decayed out at a rate that is specified by the Ignition Start-up Decay Interval table.

Index: Engine Coolant Temperature

Range: -32.0 to +32.75

Units: Crankshaft degrees

Resolution: 0.25

Ignition Startup Termination RPM

The Startup Termination RPM is the engine speed at which the timing value is switched over from a cranking mode value, to the run-mode value. The crank-mode value is determined by the location of the crankshaft sensor relative to Top Dead Center. The run-mode value is a combination of the base advance table and the startup-phase-in interval. A typical value for the Startup Termination RPM is 350 RPM for a 8 cylinder engine, 450 for a 6 cylinder engine, and 550 RPM for a 4 cylinder engine. Improper setting of this table can result in loss of timing control while the engine is running, even though the module may be able to control timing by forcing a value to the engine using the Forced Timing function.

Range: 0-600

Units RPM

Resolution: 50

Ignition Start-up Decay Interval (Pro Version only)

The values in this table specify the time between startup ignition advance term decay steps. Once the engine begins to crank for start-up, ignition advance is ramped up to the total advance value. The total advance is specified by the base advance value with all of the various adjusting terms, including the start-up term added to it. Once the advance reaches this total, composite value the start-up term begins to decay out. The values of

this table specify how much time is between each 0.25 degrees of start-up advance decay steps. If the start-up advance term is greater than zero then the term is reduced towards zero. If the term is negative then the term is advanced towards zero.

X Index: Engine coolant temperature

Y Index: Manifold absolute pressure

Range: 0.0 to 6.2

Units: Seconds

Resolution: 0.024

Ignition Start-up Phase-in Interval (Pro Version only)

The values in this table specify the amount of time between ignition advance increase steps after initial crank to start. When the engine is first cranked to start the ignition advance delivered to the engine is the value specified by the crank offset value. As the engine cranks the advance increases until it reaches the total advance. The base advance with all of the various correction terms, including the start-up term, added to it calculates the total advance. The time between 1.0 degree advance increment steps is contained in this table.

X Index: Engine coolant temperature

Y Index: Manifold absolute pressure

Range: 0 to 790

Units: milliseconds

Resolution: 4.1

IGNITION – STEADY STATE

Port Air Temperature Ignition Compensation

The values in this table specify an advance term that is added to the base ignition advance as a function of intake port air temperature. The intake air port temperature serves as a pointer into this table. The pointer selects the amount of advance to be added to the base timing value. Generally, as intake port air temperature increases this term should become more negative.

Index: Estimated Intake Port Air Temperature

Range: -32.0 to +32.75

Units: Crankshaft degrees

Resolution: 0.25

Base ECT Ignition Compensation (Pro Version only)

The values in this table specify a base amount of ignition advance to be added to the base ignition advance as a function of engine coolant temperature. The engine coolant temperature serves as a pointer into this table. The pointer selects the base engine temperature ignition advance term. The term is then corrected based on engine speed and load. The value that is looked-up from the Ignition ECT Compensation Power Modifier

table adjusts the base coolant temperature ignition term to yield the final amount of coolant temperature ignition advance to be added to the base ignition advance. The calculation is:

ECT Advance Term = Base ECT Term x ECT Power Compensation Coefficient

Index: Engine Coolant Temperature

Range: -32.0 to +32.75

Units: Crankshaft degrees

Resolution: 0.25

ECT Compensation Power Modifier (Pro Version only)

The values in this table specify how much the ignition advance term for coolant temperature is trimmed for speed and load. The base ignition correction term for ECT is adjusted based upon speed and load. This table's values specify a number that is used to multiply the base ECT ignition term by. Generally as speed and load increase the amount of ignition correction for coolant temperature decreases. At idle and light loads when the engine is cold additional ignition advance increases response and driveability. At higher engine power output however the additional advance could be detrimental to the engine. This table gives you the opportunity to scale back your ignition advance as the engine warms up.

X Index: Engine Speed, Base VE Table RPM Scale

Y Index: Manifold Absolute Pressure

Range: 0.0 to 1.0

Units: None (Multiplier)

Resolution: 0.00392

Idle Spark Control Compensation

The values in this table specify how much ignition advance is added to the base advance to assist in idle speed control. When the throttle is below the idle throttle position value the ignition timing is adjusted by these table values. Both the error in engine idle speed and the engine temperature are used to select an amount of ignition advance to be added to the base advance. The X-axis (across the screen direction) is the difference between the set, target idle engine speed and the actual engine speed. The Y-axis (up and down the screen) is the engine coolant temperature.

Typically, when the engine speed is above the target idle speed (to the right in the table) the ignition advance is reduced by adding negative advance values. This slows the engine speed. When the engine speed is below the target idle speed (In the left portion of the table) positive advance values will help the engine to accelerate to the target idle speed. Engine temperature generally affects the rate at which the engine responds to ignition advance. It also will effect the target idle speed based upon the values in the target idle speed table and the base total ignition advance based upon the ECT ignition compensation table values.

X Index: Idle speed error

Y Index: Engine coolant temperature

Range: -32.0 to 31.75
Units: Crankshaft degrees
Resolution: 0.25

Ignition Base Advance (Timing Map)

This table contains values that specify the base ignition advance to be delivered to the engine. Engine speed and manifold absolute pressure are used to select the base ignition advance. A number of compensating terms (i.e. Engine coolant temperature, Intake port temperature, etc..) are added to this value to yield the total ignition advance. Generally as volumetric efficiency increases the base advance decreases.

Note: Although values from 0 to 50 can be entered into this table, the actual amount of advance that can be delivered is limited by the Crank Offset value. Actual engine advance will not go below the Crank Offset value.

X Index: Engine Speed, Base VE Table RPM Scale
Y Index: Manifold absolute pressure
Range: Crank Index offset to 50 degrees before TDC
Units: Crankshaft degrees
Resolution: 0.25

IGNITION – KNOCK

Knock Feedback Retard Limit (Pro Version only)

The values in this table specify the maximum amount of ignition advance that can be pulled out of the total when knock is sensed. When the knock-input signal goes low (below 2.0V) the ECM considers the engine to be spark knocking. The ECM does not check the knock sensor module signal until coolant temperature has exceeded 120 F.

X Index: Engine Speed, Base VE Table RPM Scale
Y Index: Manifold absolute pressure
Range: 0 to 31.75
Units: Crankshaft degrees
Resolution: 0.25

Knock Feedback Retard Interval (Pro Version only)

This table contains values that specify the time period between ignition advance reduction steps when knock is sensed. The ECM recognizes knock when the knock sensor input signal falls below approximately 2.0 Volts. Once knock is sensed, if the knock feedback limit allows it, the total ignition advance will be reduced by 1 degree at the time intervals specified in the table. Ignition advance will continue to reduce while the signal input is low until it reaches the limit specified by the Knock Feedback Retard Limit. Speed and manifold pressure are used to select the retard interval.

X Index: Engine Speed, Base VETable RPM Scale

Y Index: Manifold absolute pressure
Range: 0 to 12.5
Units: Seconds
Resolution: 0.049

Knock Feedback Advance Interval (Pro Version only)

This table contains values that specify the time period between ignition advance increase steps when knock no longer sensed. The ECM recognizes no knock when the knock sensor input signal rises above approximately 6.0 Volts. Once knock is no longer sensed, if the knock feedback term has not reached 0, the total ignition advance will be increased by .5 degrees at the time intervals specified in the table. The knock feed back term will continue to decrease while the signal input is high until it reaches 0. Speed and manifold pressure are used to select the retard interval.

X Index: Engine Speed, Base VE Table RPM Scale
Y Index: Manifold absolute pressure
Range: 0 to 12.5
Units: Seconds
Resolution: 0.049

IGNITION – DWELL CONTROL

Ignition Dwell Period

The values in this table specify the length of time that the ignition coil dwells as a function of engine speed. The dwell period is the length of time that current conducts through the primary side of the ignition coil. The peak current in the coil increases as the values in this table increase. Note however that the ignition module that the ECM drives typically has a built in current limiting circuit. If the dwell is made too large higher stresses are placed on the ignition module which could lead to premature ignition module failure.

HEI and TFI coils typically require approximately 5.3 milliseconds of dwell. CD ignition units generally do not require more than 1.0 to 2.5 milliseconds.

Index: Engine Speed
Range: 0 to 16.3
Units: milliseconds
Resolution: 0.064

IDLE MENU

IDLE CONFIGURATION SCREEN

Transmission Type

Set this switch to the value appropriate for your application. Idle control strategy in the ECM is handled differently for each setting of this calibration table. The idle control is much more aggressive for a manually-controlled transmission, vs. a less aggressive control strategy for an automatic transmission.

Maximum % Throttle Idle Mode

This value specifies the throttle position that identifies idle mode to the ECM. Throttle positions below this value allow the ECM to try to control idle speed. Once the throttle opens over this value the ECM relinquishes control of idle. The percentage of throttle is used as the measurement of throttle, not throttle voltage. Refer to fully closed and fully open TPS calibration values for the determination of percent throttle.

A reasonable starting point for this value is approximately 3%.

Range: 0 to 100

Units: percent (%)

Resolution: 0.392

Idle Spark Control

This button provides a shortcut to access your Idle Spark table from the Idle Configuration Screen. See the Idle Spark section under the Ignition Menu for further details.

Maximum % Throttle Idle Spark

This value specifies the throttle position that identifies the Ignition Idle Spark Compensation mode to the ECM. Throttle positions below this value allow the ECM to try to control idle speed using ignition timing. Once the throttle opens over this value the ECM relinquishes control of this compensation table. The percentage of throttle is used as the measurement of throttle, not throttle voltage. Refer to fully closed and fully open TPS calibration values for the determination of percent throttle.

A reasonable starting point for this value is approximately 1 to 3%.

Range: 0 to 100

Units: percent (%)

Resolution: 0.392

Idle Dampening

When set to High, this feature will cause the Idle Mode Decay Rate to be invoked only when Throttle Position is below 3%. Setting this feature to Low will cause the Idle Mode Decay Rate to be active at the Estimated Mass Airflow value specified in the Dampening MAF Threshold table.

TPS Setpoints

This button provides a shortcut to access your Throttle Position Sensor Setpoints from the Idle Configuration Screen. See the on-screen instructions for further details.

Idle Attack Rate

This table controls the overall aggressiveness of the DFI ECM's Idle Control Strategy. Values in this table range between 0 and 10, with lower values being more aggressive, and higher values being less aggressive. Use this table to “zero-in” on the exact Idle Control Strategy that you need for maximum control of your engine. When programming a version 3.2 or higher ECM with a calibration that was developed in an ECM with a version 3.1 or lower calibration, place a value of 3 in this table to yield an aggressiveness equivalent to that of the older ECM.

Idle Mode Decay Rate

The values in this table specify the rate at which the engine speed is decayed out to reach the target idle speed. Once the actual engine speed reaches the target idle speed for the given load conditions, this decay rate is disregarded and will no longer affect the engine speed.

Range: 0 to 10

Units: Magnitude of Decay

Resolution: 1.0

Idle Air Controller (IAC) Control Loop Tuning

Use this control to select one of a number of preset Idle Control settings. These presets may not be the optimal setting for your combination, but can be used as starting points to get you close to where your Idle Control Strategy should be set at. Use the ‘Custom’ setting to edit the following individual calibration tables:

Idle Control Proportional Gain

This value specifies the idle bypass air response to the error in idle speed. The idle speed error is the difference between the actual and the target idle speed. Idle air bypass is the amount of air that is leaked passed the throttle blade by the idle air control (IAC) motor. The error in idle speed is multiplied by the Idle Control Proportional Gain value. The result is then applied to the idle air motor to command it in the opposite direction of the idle error. The result of the multiplication is a number that is proportional to the amount of idle error. The movement of the IAC motor then is proportional to the amount of idle speed error. Larger values of proportional gain cause the idle bypass response to idle speed error to be large. Smaller gain values cause smaller changes in bypass air for changes in idle speed error. Too large of a gain value will cause idle speed to fluctuate wildly (oscillate). Too small a value will not pull idle speeds close to the target idle speed. Refer also to Idle

Control Integral and Derivative gain and Maximum % Throttle Idle Mode calibration values. This value should be tuned first, prior to the Integral and Derivative gains.

Range: 0 to 100

Units: None (Coefficient)

Resolution: 0.392

Idle Control Integral Gain

This value specifies the idle bypass air response to the total of past errors in idle speed added together. The idle speed error is the difference between the actual and the target idle speed. Idle air bypass is the amount of air that is leaked passed the throttle blade by the idle air control (IAC) motor. The most recent past idle speed errors are summed, added together, to form a number that integrates past errors into a single value. The integrated idle error value is multiplied by the Idle Control Integral Gain value. The result is then applied to the idle air motor to command it in the opposite direction of the integrated idle speed error.

Integral error response is helpful in obtaining precise idle speeds. In many cases proportional gain values can not be made large enough to pull the idle speed close enough to the target speed value. Proportional gains, if made large to make large idle bypass response to speed errors, can cause drastic over/under shoots. The integral control tends to act upon average speed errors and therefore does not respond as quickly allowing its effects to be more gradual.

The gradual response to error that the integral control gives however can cause instability as well. Because idle air responds slowly to idle speed error its inherent lag causes idle air changes to occur after the actual change in idle speed. The tardiness of the response can cause over and undershoots in idle speed. Refer also to Idle Control Proportional and Derivative gain and Maximum % Throttle Idle Mode calibration values.

Range: 0 to 100

Units: None (Coefficient)

Resolution: 0.392

Idle Control Differential Gain

This value specifies the amount that the idle air bypass changes in response to a sudden change in engine speed while idling. Idle air bypass is the amount of air that is leaked passed the throttle blade by the idle air control (IAC) motor. When a sudden change in idle speed occurs the rate of the change is multiplied by the derivative gain value and then applied to the IAC motor. At high rates of RPM change then the IAC, air passed around the throttle, is moved more than at slower rates of RPM change.

The derivative portion of the idle control strategy in the ECM is used to counteract the affects of putting the vehicle in to gear or taking it out of gear. It is intended to smooth out dips and peaks in the idle speed caused by sudden load changes. Refer also to Idle Control Proportional and Integral gain and Maximum % Throttle Idle Mode calibration values.

Range: 0 to 100

Units: None (Coefficient)

Resolution: 0.392

IDLE MENU SELECTIONS

Target Idle Speed

The values in this table specify the desired engine speed when the throttle is closed. Engine coolant temperature is used to select a value from this table. The ECM controls the position of a plunger that regulates airflow around the throttle blade (Idle Air Control Motor) when the throttle is closed to regulate engine speed. The value selected from this table is the speed that the ECM tries to maintain through control of the air bypass plunger when the throttle is closed. Generally, at lower temperatures, idle speeds are set several hundred RPM higher than the normal hot engine idle speed.

Index: Engine coolant temperature

Range: 0 to 2550

Units: engine speed (RPM)

Resolution: 10

Minimum IAC Position vs Coolant Temperature (Pro Version only)

The values in this table specify the minimum limit of throttle bypass air that the ECM allows. Engine coolant temperature is used to select the minimum idle air. The values in this table should be set at a level just below that of the idle air position for the given engine coolant temperature and associated idle speed. The purpose of this table is to prevent large speed undershoots upon rapid decelerations. Refer also to target idle speed and Idle Proportional, Integral and Derivative gain and Maximum % Throttle Idle Mode tables.

Index: Engine coolant temperature

Range: 0 to 100

Units: % of Idle bypass air

Resolution: 0.392

Maximum IAC Position vs Coolant Temperature (Pro Version only)

The values in this table specify the maximum limit of throttle bypass air that the ECM allows. Engine coolant temperature is used to select the maximum idle air. The values in this table should be set at about twice the level of the idle air position for the given engine coolant temperature and associated idle speed. The purpose of this table is to prevent large delays in resuming idle speed control when returning to idle from off-idle conditions. Refer also to target idle speed and Idle Proportional, Integral and Derivative gains and Maximum % Throttle Idle Mode tables.

Index: Engine coolant temperature

Range: 0 to 100

Units: % of idle bypass air

Resolution: 0.392

IAC Starting Position vs. Engine Temperature

The values in this table specify what amount of air that will be bypassed around the throttle when starting the engine. Engine coolant temperature is used to select a value from this table. The Idle Air Control (IAC) motor is controlled by the ECM to regulate the amount of air that is leaked around the throttle blade. Upon starting the ECM places the IAC in a position to bypass the amount of air specified by the table value that is selected by the coolant temperature.

Generally at colder engine temperatures the starting position of the IAC is higher than at warm engine temperatures. High initial starting speeds usually indicate that the starting position is too high. Low initial starting speeds indicate too low a starting position. For best initial start and driveability it is often best to set the starting position to allow slightly higher than target idle speed at initial start-up.

Index: Engine coolant temperature

Range: 0 to 100

Units: % of idle bypass air

Resolution: 0.392

Idle Control Delay (Pro Version only)

This calibration table contains values that specify how long after initial crank to start the ECM will wait to begin idle control. Engine coolant temperature is used to select a value from this table. When the engine begins to crank the Idle Air Control (IAC) motor is placed in its starting position. It will remain there until the number of crankshaft rotations specified by the value selected from this table has elapsed. Once enough crankshaft rotations have occurred normal idle control will begin. Refer also to Idle Control Proportional, Integral and Derivative gains, Maximum % Throttle Idle Mode and IAC Starting Position calibration values.

Index: Engine coolant temperature

Range: 0 to 255

Units: Crankshaft rotations

Resolution: 1

Throttle Follower

The values in this table specify the throttle bypass air that the ECM sets as a function of throttle position. The recommended minimum index in this table should be set at about 5% for 0% throttle opening, and the maximum index about 35-40% at 50% throttle opening. The purpose of this table is to employ smooth transitions in resuming idle speed control when returning to idle from off-idle conditions. Refer also to target idle speed and Idle Proportional, Integral and Derivative gains and Maximum % Throttle Idle Mode tables.

Range: 0 to 100

Units: % throttle

Resolution: .39

NITROUS MENU

NITROUS – STAGE 1

STAGE 1 – CONFIGURATION

Stage 1 - Nitrous System Enable

This is a master ON/OFF switch for Stage 1 nitrous. If this switch is in the off position the nitrous functions will not activate even if the 12-Volt enable to NOS port 1 is energized. Always use the F10 function key to send the information to the ECM.

Stage 1 Fuel Trim/Ignition Retard

These buttons are shortcuts to the optional Ignition Retard and Fuel Trim calibration tables associated with Stage 1 NOS system activation.

NOS Engine Saver Enable – All stages

This is an ON/OFF switch to enable or disable the Lean Linear O2 Threshold table. This switch activates the UEGO sensor to monitor the O2 lean limit. The ECM must be equipped, and configured with an UEGO (linear) sensor in order for this function to operate. Refer to the O2 Threshold table below for setting these limits.

Stage 1 - Engine Saver O2 A:F Threshold (Wideband O2 Only)

When the ECM is configured for a Universal Exhaust Gas Oxygen (UEGO) sensor fuel feedback control, this value specifies what the leanest air to fuel ratio, to leave stage 1 NOS active. The UEGO module provides the ECM with a signal that is proportional to the air to fuel mixture of the engine. If the ECM sees an air to fuel ratio that is leaner than the Lean Linear O2 Threshold the NOS is turned off and will not be re-enabled until the ignition switch is cycled off and then back on. This setting is not active unless the NOS Linear O2 sensor switch is enabled.

Range: 10 to 20

Units: Ratio, air to fuel

Resolution: 0.0392

NOS BSFC – All Stages

This value specifies the Break Specific Fuel Consumption (BSFC) of the engine when nitrous oxide is delivered. BSFC is a measure of how much power is generated per fuel

flow. It is measured in horsepower per pounds of fuel flow per hour. The ECM uses this value to determine how much extra fuel is delivered when nitrous oxide is flowing. It uses the values provided in the number of NOS orifices, size of NOS orifices and NOS pressure to calculate the additional amount of fuel required. Calibration tables are also provided for trimming the calculated fuel addition.

A reasonable starting value is approximately 0.50.

Range: 0.39 to 0.66

Units: HP per lbs./hr

Resolution: 0.0026

Stage 1 - Orifice Size Calculation

When set to auto, the NOS flow rate is determined by the values entered in the Orifice Size and Number of Orifices calibration tables. Setting this switch to manual allows you to enter your desired NOS flow rate, in Pounds /Hr. The number of Orifices and Orifice Size calibration tables are then set automatically to achieve the flow rate that was entered previously.

Stage 1 - Number of Orifices

This value specifies how many Nitrous Oxide engine feed orifices, or pills that are controlled by the stage 1 NOS relay.

Range: 0 to 8

Units: number of orifices

Resolution: 1

Stage 1 - NOS Orifice Diameter

This value specifies the diameter, in inches, of each of the stage 1 nitrous oxide orifices. The ECM assumes that all of the orifices in stage 1 are this value.

Range: 0 to 0.14

Units: inches

Resolution: 0.00055

Stage 1 - Line Pressure

This value specifies what the Nitrous Oxide bottle pressure is that connects to stage 1 NOS orifices.

Range: 550 to 1500

Units: pounds per square inch (PSI)

Resolution: 3.73

Stage 1 - Delay

This value specifies the time delay for energizing the stage 1 nitrous oxide control relay. When the NOS arming signal provided to the ECM is above 6.0 volts and the engine

speed and throttle position are over their respective NOS enable limits, the stage 1 NOS relay is activated after the time period specified by this value. All three conditions, Enabled, RPM and TPS, must be satisfied before the delay timer starts. If any one of the conditions is not true the delay timer will be reset to 0.

Range: 0 to 33.4

Units: Seconds

Resolution: 0.13

Stage 1 - Minimum %Throttle

This value specifies the minimum throttle that the stage 1 nitrous oxide relay can be energized. A value above the 'Enable' threshold is required to energize the NOS Relay. As long as the value then remains above the 'Disable' level, the relay output will continue to be energized. Refer also to stage 1 delay and minimum RPM calibration values and fully closed/open throttle voltage calibration settings. Be sure that the checkbox in the 'Enabled' column of the configuration table is checked if you want to use this parameter to control NOS system activation.

Range: 0 to 100

Units: % of throttle range

Resolution: 0.392

Stage 1 - Minimum RPM

This value specifies the minimum engine speed that the stage 1 nitrous oxide relay can be energized. A value above the 'Enable' threshold is required to energize the NOS Relay. As long as the value then remains above the 'Disable' level, the relay output will continue to be energized. Refer also to stage 1 delay and minimum throttle calibration values. Be sure that the checkbox in the 'Enabled' column of the configuration table is checked if you want to use this parameter to control NOS system activation.

Range: 2000 to 12700

Units: RPM

Resolution: 50

Stage 1 - Manifold Pressure Threshold

This value specifies the Manifold Absolute Pressure threshold required to allow the stage 1 nitrous oxide relay to be energized. Under normal operation, a value above the 'Enable' threshold is required to energize the NOS Relay. As long as the value then remains above the 'Disable' level, the relay output will continue to be energized. If the 'Active State' switch is placed in the 'Below Low Setpoint' position, this logic will be reversed. Be sure that the checkbox in the 'Enabled' column of the configuration table is checked if you want to use this parameter to control NOS system activation.

Range: 2000 to 12700

Units: RPM

Resolution: 50

Stage 1 - NOS Fuel Delay

The value in this table determines the amount of time that is allowed to pass from the time that nitrous is enabled, to the time that additional fuel enrichment is actually injected into the engine. In some nitrous applications, a small delay is required in order to ensure that both the nitrous oxide, and the associated fuel enrichment, reach the combustion chamber simultaneously.

NOS - RPM Limit (All Stages)

The value in this table indicates when the Nitrous system will be turned off due to an over-RPM condition. No Nitrous will be injected for engine speeds at or above the number specified in this calibration table. Nitrous operation will commence at 100 RPM below this set value.

Stage 1 - ECM Enable Input

This switch will enable the NOS input line check within the ECM so that the NOS system will not be activated, regardless of the NOS control strategy, until the input to the ECM is activated for each stage individually. If this switch is set to disable, the NOS system will be allowed to activate when all of the parameters in the NOS control strategy are satisfied, without waiting for an signal on the NOS input lines for each stage.

Stage 1 - Dual Mapping A:F Ratio System Enable

This switch will enable the DFI Dual Mapping function as a function of the NOS enable conditions when set to Enable. When set to disable, the Dual Mapping function will be disabled, regardless of the state of the NOS control system.

Dual Mapping Control Strategy Uses:

This feature will allow you to switch from a primary air to fuel map to a secondary air to fuel map by enabling the ECM nitrous stage one control output. The map transition will only take place if the NOS control parameters, as specified in the NOS1 configuration screen, are satisfied. If the hardware input signal line check is enabled by the NOS ECM enable input control on the same configuration screen, a transmission brake, line lock, clutch switch, or any 12 volt high signal input can be used to activate this feature by connecting it directly to the NOS Stage 1 ECM enable input. The Dual-Mapping control strategy can be used for performance gains in situations such as vehicle starting-line launch, and as a secondary power-enrichment mode to instantly gain performance without sacrificing overall vehicle driveability.

Turbo Boost Builder System Enable

Boost Builder is a function that uses a unique 2-step revolution limiting function to build boost pressure in order to achieve quicker turbo spool up for faster starting line launches or maintain boost between shifts. You can preset the low, middle, and high RPM setpoints, along with the required change in manifold pressure (MAP) needed to advance to the next step. When your engine reaches the threshold RPM for a given step, the 2-Step rev limiter is set to that engine speed value. The engine is held at that speed until the MAP increases beyond the preset level for that step. Once all the steps have been performed, the engine is held at the preset 2-Step rev limit value. The 2-step function must be configured and enabled properly using the NOS 1 enable input (L2 on the ECM Header, or Position C that is the Light Green w/Black Trace wire on the 5-way NOS connector.)

Stage 1 - Closed Loop Fueling Enable

This switch will allow closed-loop fueling to remain in effect when the NOS, or Dual Mapping system is engaged. If set to disable, the closed loop correction value will be forced to zero when the current NOS stage, or Dual Mapping Function is activated

NOS Asynchronous Fueling Compensation - All Stages

This table, when enabled, offers a way to blend additive fuel due to acceleration into the overall fueling strategy being used while the Nitrous Oxide System is active. Values in this table may vary between 0 and 10. Lower values will blend the additional fuel into the overall fuel mass quicker, while higher values will slowly integrate dynamic fueling into the overall fuel mass.

Total Fuel Flow Rate (lbs./hr) – monitor

This is a monitor function that displays the total fuel in lbs/hr that is used by the engine. This would include the NOS fuel when NOS is active.

NOS Fuel Enrichment (lbs./hr) – monitor

This is a monitor function that displays the nitrous fuel in lbs/hr only when the engine is running. This value contains the calculated fueling number obtained from the nitrous configuration tables, as well as, the nitrous fuel trim table.

NOS Estimated Horsepower – monitor

This is a monitor function that displays effective amount of horsepower that would be generated by the given settings for the current stage of nitrous being edited.

STAGE 1 - IGNITION RETARD

Stage 1 - Ignition Retard

The values in this table specify the amount of ignition advance to be added to the base ignition advance when the first stage of NOS is activated. The engine RPM is used as a pointer into this table to select the advance term.

Index: Engine Speed

Range: -32.0 to +32.75

Units: Crankshaft degrees

Resolution: 0.25

STAGE 1- FUEL TRIM

Stage 1 – Fuel Trim

The values in this table specify the amount of positive or negative fuel trim, in lbs/hr, that is added to the main NOS fuel flow. This table is intended to compensate for overall NOS fuel efficiency. Some of the factors that effect NOS efficiency are engine size, cylinder bore diameter, combustion chamber layout, restrictions or pressure drops in NOS plumbing, and NOS solenoids, the injection point of the nitrous, and overall bottle layout.

Range: -50 to 180

Units: lbs./hr

Resolution: 0.90

NITROUS- STAGE 2

STAGE 2- CONFIGURATION

Stage 2 - Nitrous System Enable

This is a master ON/OFF switch for Stage 2 nitrous. If this switch is in the off position the nitrous functions will not activate even if the 12-Volt enable to NOS port 2 is energized. Always use the F10 function key to send the information to the ECM.

Stage 2 Fuel Trim/Ignition Retard

These buttons are shortcuts to the optional Ignition Retard and Fuel Trim calibration tables associated with Stage 2 NOS system activation.

Engine Saver O2 Sensor Enable – All Stages

This is an ON/OFF switch to enable or disable the Lean Linear O2 Threshold table. This

switch activates the UEGO sensor to monitor the O2 lean limit. The ECM must be equipped, and configured with an UEGO (linear) sensor in order for this function to operate. Refer to the O2 Threshold table below for setting these limits

Stage 2 - Engine Saver O2 A:F Threshold (Wideband O2 Only)

When the ECM is configured for a Universal Exhaust Gas Oxygen (UEGO) sensor fuel feedback control, this value specifies what the leanest air to fuel ratio, to leave stage 2 NOS active. The UEGO module provides the ECM with a signal that is proportional to the air to fuel mixture of the engine. If the ECM sees an air to fuel ratio that is leaner than the Lean Linear O2 Threshold the NOS is turned off and will not be re-enabled until the ignition switch is cycled off and then back on. This setting is not active unless the NOS Linear O2 sensor switch is enabled.

Range: 10 to 20
Units: Ratio, air to fuel
Resolution: 0.0392

NOS BSFC – All Stages

This value specifies the Break Specific Fuel Consumption (BSFC) of the engine when nitrous oxide is delivered. BSFC is a measure of how much power is generated per fuel flow. It is measured in horsepower per pounds of fuel flow per hour. The ECM uses this value to determine how much extra fuel is delivered when nitrous oxide is flowing. It uses the values provided in the number of NOS orifices, size of NOS orifices and NOS pressure to calculate the additional amount of fuel required. Calibration tables are also provided for trimming the calculated fuel addition.

A reasonable starting value is approximately 0.50.

Range: 0.39 to 0.66
Units: HP per lbs./hr
Resolution: 0.0026

Stage 2 - Orifice Size Calculation

When set to auto, the NOS flow rate is determined by the values entered in the Orifice Size and Number of Orifices calibration tables. Setting this switch to manual allows you to enter your desired NOS flow rate, in Pounds /Hour. The number of Orifices and Orifice Size calibration tables are then set automatically to achieve the flow rate that was entered previously

Stage 2 - Number of Orifices

This value specifies how many Nitrous Oxide engine feed orifices are controlled by the stage 2 NOS relay.

Range: 0 to 8
Units: number of orifices
Resolution: 1

Stage 2 - Orifice Diameter

This value specifies the diameter, in inches, of each of the stage 2 nitrous oxide orifices. The ECM assumes that all of the orifices in stage 2 are this value.

Range: 0 to 0.14
Units: inches
Resolution: 0.00055

Stage 2 - Line Pressure

This value specifies what the Nitrous Oxide bottle pressure is that connects to Stage 2 NOS orifices.

Range: 550 to 1500
Units: pounds per square inch (PSI)
Resolution: 3.73

Stage 2 - Delay

This value specifies the time delay for energizing the stage 2 nitrous oxide control relay. When the NOS arming signal provided to the ECM is above 6.0 volts, the engine speed and throttle position are over their respective NOS stage 2 enable limits and the stage 1 NOS delay has elapsed, the stage 2 NOS relay is activated after the time period specified by this value. All four conditions, Enabled, RPM, TPS and stage 2 delay, must be satisfied before the delay timer starts. If any one of the conditions is not true the delay timer will be reset to 0.

Range: 0 to 33.4
Units: Seconds
Resolution: 0.13

Stage 2 - Minimum %Throttle

This value specifies the minimum throttle that the stage 2 nitrous oxide relay can be energized. A value above the 'Enable' threshold is required to energize the NOS Relay. As long as the value then remains above the 'Disable' level, the relay output will continue to be energized. Refer also to stage 2 delay and minimum RPM calibration values and fully closed/open throttle voltage calibration settings. Be sure that the checkbox in the 'Enabled' column of the configuration table is checked if you want to use this parameter to control NOS system activation.

Range: 0 to 100
Units: % of throttle range
Resolution: 0.392

Stage 2 - Minimum RPM

This value specifies the minimum engine speed that the stage 2 nitrous oxide relay can be energized. A value above the 'Enable' threshold is required to energize the NOS Relay. As long as the value then remains above the 'Disable' level, the relay output will continue to be energized. Refer also to stage 2 delay and minimum throttle calibration values. Be sure that the checkbox in the 'Enabled' column of the configuration table is checked if you want to use this parameter to control NOS system activation.

Range: 2000 to 12700

Units: RPM

Resolution: 50

Stage 2 - Manifold Pressure Threshold

This value specifies the Manifold Absolute Pressure threshold required to allow the stage 2 nitrous oxide relay to be energized. Under normal operation, a value above the 'Enable' threshold is required to energize the NOS Relay. As long as the value then remains above the 'Disable' level, the relay output will continue to be energized. If the 'Active State' switch is placed in the 'Below Low Setpoint' position, this logic will be reversed. Be sure that the checkbox in the 'Enabled' column of the configuration table is checked if you want to use this parameter to control NOS system activation.

Range: 2000 to 12700

Units: RPM

Resolution: 50

Stage 2 - Fuel Delay

The value in this table determines the amount of time that is allowed to pass from the time that nitrous is enabled, to the time that additional fuel enrichment is actually injected into the engine. In some nitrous applications, a small delay is required in order to ensure that both the nitrous oxide, and the associated fuel enrichment, reach the combustion chamber simultaneously.

NOS RPM Limit - All Stages

The value in this table indicates when the Nitrous system will be turned off due to an over-RPM condition. No Nitrous will be injected for engine speeds at or above the number specified in this calibration table

Stage 2 - ECM Enable Input

This switch will enable the NOS input line check within the ECM so that the NOS system will not be activated, regardless of the NOS control strategy, until the input to the ECM is activated for each stage individually. If this switch is set to disable, the NOS system will be

allowed to activate when all of the parameters in the NOS control strategy are satisfied, without waiting for an signal on the NOS input lines for each stage.

Stage 2 - Closed Loop Fueling Enable

This switch will allow closed-loop fueling to remain in effect when the NOS, or Dual Mapping system is engaged. If set to disable, the closed loop correction value will be forced to zero when the current NOS stage, or Dual Mapping Function is activated

NOS Asynchronous Fueling Compensation - All Stages

This table, when enabled, offers a way to blend additive fuel due to acceleration into the overall fueling strategy being used while the Nitrous Oxide System is active. Values in this table may vary between 0 and 10. Lower values will blend the additional fuel into the overall fuel mass quicker, while higher values will slowly integrate dynamic fueling into the overall fuel mass.

Total Fuel Flow Rate (lbs./hr) – monitor

This is a monitor function that displays the total fuel in lbs./hr that is used by the engine. This would include the NOS fuel when NOS is active.

NOS Fuel Enrichment (lbs./hr) – monitor

This is a monitor function that displays the nitrous fuel in lbs./hr only when NOS is active. This value contains the calculated fueling number obtained from the nitrous configuration tables, as well as, the nitrous fuel trim table.

NOS Estimated Horsepower – monitor

This is a monitor function that displays effective amount of horsepower that would be generated by the given settings for the current stage of nitrous being edited.

STAGE 2- IGNITION RETARD

Stage 2 - Ignition Retard

The values in this table specify the amount of ignition advance to be added to the base ignition advance when the second stage of NOS is activated. The engine RPM is used as a pointer into this table to select the advance term.

Index: Engine Speed
Range: -32.0 to +32.75
Units: Crankshaft degrees
Resolution: 0.25

STAGE 2- FUEL TRIM

Stage 2 - Fuel Trim

The values in this table specify the amount of positive or negative fuel trim, in lbs./hr, that is added to the main NOS fuel flow. This table is intended to compensate for overall NOS fuel efficiency. Some of the factors that effect NOS efficiency are engine size, cylinder bore diameter, combustion chamber layout, restrictions or pressure drops in NOS plumbing, and NOS solenoids, the injection point of the nitrous, and overall bottle layout.

Range: -50 to 180

Units: lbs./hr

Resolution: 0.90

NITROUS- STAGE 3

STAGE 3– CONFIGURATION

Stage 3 - Nitrous System Enable

This is a master ON/OFF switch for Stage 3 nitrous. If this switch is in the off position the nitrous functions will not activate even if the 12-Volt enable to NOS port 3 is energized. Always use the F10 function key to send the information to the ECM.

Stage 3 Fuel Trim/Ignition Retard

These buttons are shortcuts to the optional Ignition Retard and Fuel Trim calibration tables associated with Stage 3 NOS system activation.

Engine Saver O2 Sensor Enable – All stages

This is an ON/OFF switch to enable or disable the Lean Linear O2 Threshold table. This switch activates the UEGO sensor to monitor the O2 lean limit. The ECM must be equipped, and configured with an UEGO (linear) sensor in order for this function to operate. Refer to the O2 Threshold table below for setting these limits.

Stage 3 - Engine Saver O2 A:F Threshold (Wideband O2 Only)

When the ECM is configured for a Universal Exhaust Gas Oxygen (UEGO) sensor fuel feedback control, this value specifies what the leanest air to fuel ratio, to leave stage 3 NOS active. The UEGO module provides the ECM with a signal that is proportional to the air to fuel mixture of the engine. If the ECM sees an air to fuel ratio that is leaner than the Lean Linear O2 Threshold the NOS is turned off and will not be re-enabled until the

ignition switch is cycled off and then back on. This setting is not active unless the NOS Engine Saver switch is enabled.

Range: 10 to 20
Units: Ratio, air to fuel
Resolution: 0.0392

NOS BSFC – All stages

This value specifies the Break Specific Fuel Consumption (BSFC) of the engine when nitrous oxide is delivered. BSFC is a measure of how much power is generated per fuel flow. It is measured in horsepower per pounds of fuel flow per hour. The ECM uses this value to determine how much extra fuel is delivered when nitrous oxide is flowing. It uses the values provided in the number of NOS orifices, size of NOS orifices and NOS pressure to calculate the additional amount of fuel required. Calibration tables are also provided for trimming the calculated fuel addition.

A reasonable starting value is approximately 0.50.

Range: 0.39 to 0.66
Units: HP per lbs./hr
Resolution: 0.0026

Stage 3 - Delay

This value specifies the time delay for energizing both the stage 1 and stage 2 nitrous oxide control relays. When the NOS arming signal provided to the ECM is above 6.0 volts, the engine speed and throttle position are over their respective NOS stage 3 enable limits, and the stage 2 NOS delay has elapsed, both stage 1 and stage 2 NOS relays are activated after the time period specified by this value. All four conditions, Enabled, RPM, TPS and stage 2 delay, must be satisfied before the delay timer starts. If any one of the conditions is not true the delay timer will be reset to 0.

Range: 0 to 33.4
Units: Seconds
Resolution: 0.13

Stage 3 - Minimum %Throttle

This value specifies the minimum throttle that the stage 1 nitrous oxide relay can be energized. A value above the 'Enable' threshold is required to energize the NOS Relay. As long as the value then remains above the 'Disable' level, the relay output will continue to be energized. Refer also to stage 1 delay and minimum RPM calibration values and fully closed/open throttle voltage calibration settings. Be sure that the checkbox in the 'Enabled' column of the configuration table is checked if you want to use this parameter to control NOS system activation.

Range: 0 to 100
Units: % of throttle range
Resolution: 0.392

Stage 3 - Minimum RPM

This value specifies the minimum engine speed that the stage 1 nitrous oxide relay can be energized. A value above the 'Enable' threshold is required to energize the NOS Relay. As long as the value then remains above the 'Disable' level, the relay output will continue to be energized. Refer also to stage 1 delay and minimum throttle calibration values. Be sure that the checkbox in the 'Enabled' column of the configuration table is checked if you want to use this parameter to control NOS system activation.

Range: 2000 to 12700
Units: RPM
Resolution: 50

Stage 3 - Manifold Pressure Threshold

This value specifies the Manifold Absolute Pressure threshold required to allow the stage 1 nitrous oxide relay to be energized. Under normal operation, a value above the 'Enable' threshold is required to energize the NOS Relay. As long as the value then remains above the 'Disable' level, the relay output will continue to be energized. If the 'Active State' switch is placed in the 'Below Low Setpoint' position, this logic will be reversed. Be sure that the checkbox in the 'Enabled' column of the configuration table is checked if you want to use this parameter to control NOS system activation.

Range: 2000 to 12700
Units: RPM
Resolution: 50

Stage 3 - Fuel Delay

The value in this table determines the amount of time that is allowed to pass from the time that nitrous is enabled, to the time that additional fuel enrichment is actually injected into the engine. In some nitrous applications, a small delay is required in order to ensure that both the nitrous oxide, and the associated fuel enrichment, reach the combustion chamber simultaneously.

NOS RPM Limit - All Stages

The value in this table indicates when the Nitrous system will be turned off due to an over-RPM condition. No Nitrous will be injected for engine speeds at or above the number specified in this calibration table

Stage 3 - ECM Enable Input

This switch will enable the NOS input line check within the ECM so that the NOS system will not be activated, regardless of the NOS control strategy, until the input to the ECM is

activated for each stage individually. If this switch is set to disable, the NOS system will be allowed to activate when all of the parameters in the NOS control strategy are satisfied, without waiting for an signal on the NOS input lines for each stage.

NOS Asynchronous Fueling Compensation - All Stages

This table, when enabled, offers a way to blend additive fuel due to acceleration into the overall fueling strategy being used while the Nitrous Oxide System is active. Values in this table may vary between 0 and 10. Lower values will blend the additional fuel into the overall fuel mass quicker, while higher values will slowly integrate accelerative fueling into the overall fuel mass.

Total Fuel Flow Rate (lbs./hr) – monitor

This is a monitor function that displays the total fuel in lbs/hr that is used by the engine. This would include the NOS fuel when NOS is active.

NOS Fuel Enrichment (lbs./hr) – monitor

This is a monitor function that displays the nitrous fuel in lbs/hr only when NOS is active. This value contains the calculated fueling number obtained from the nitrous configuration tables, as well as, the nitrous fuel trim table.

NOS Estimated Horsepower – monitor

This is a monitor function that displays effective amount of horsepower that would be generated by the given settings for the current stage of nitrous being edited.

STAGE 3 - IGNITION RETARD

Stage 3 - Ignition Compensation

The values in this table specify the amount of ignition advance to be added to the base ignition advance when both the first and second stages of NOS are activated. The engine RPM is used as a pointer into this table to select the advance term.

Index: Engine Speed

Range: -32.0 to +32.75

Units: Crankshaft degrees

Resolution: 0.25

STAGE 3 - FUEL TRIM

Stage 3 - Fuel Trim

The values in this table specify the amount of positive or negative fuel trim, in lbs./hr, that is added to the main NOS fuel flow. This table is intended to compensate for overall NOS fuel efficiency. Some of the factors that effect NOS efficiency are engine size, cylinder bore diameter, combustion chamber layout, restrictions or pressure drops in NOS plumbing, and NOS solenoids, the injection point of the nitrous, and overall bottle layout.

Range: -50 to 180

Units: lbs./hr

Resolution: 0.90

DATA LOGGING

CONFIGURATION

There are 2 steps involved with Data Logging in CalMap. First, a configuration must be established based on the data that you wish to retrieve from the Engine Control Module. To create a configuration, select the Data Logging menu from the CalMap menu bar, then select the sub item labeled Configuration. Several options exist on this level:

Configure

This menu item allows you to configure the CalMap data logging subsystem to track the variables that you choose, set the sampling rate, and edit the triggering conditions that will start the data recording process. Pre-made configurations can be loaded, created and saved using this menu.

Load Configuration

This will load a pre-existing configuration into the Data Logging subsystem, and then load the Data Logging subsystem.

Save Configuration

This will save the current settings to a user-specified filename.

Set Autolog to Other

Sets the CalMap Autolog system to log data according to any pre-defined configuration.

Configuring a CalMap Data Logging Session

Begin configuration by selecting which variables that you wish to log from the ECM in a real-time manner. Using the mouse, click on the Log Variable 1 pull down selection box. Highlight the desired variable and press the ENTER key. Do this for as many variables as you wish to log (up to 6 variables). Next, select the data sample rate from the Sample Rate pull down selection box. Note that data from sample rates higher than 10 samples/sec are not drawn on the screen in real-time mode. Data from these rates must be saved in a logging file, and viewed using the CalMap Data Analysis subsystem. Next, select the duration in seconds of the sample you want to log. Up to 1 hour of data can be logged per session. Select the triggering mode from the Triggering drop down selection box. If Manual Triggering of the data logging function is enabled, you will have to press the ENTER key on the keyboard to begin data acquisition. If Automatic Triggering is enabled, the Automatic Trigger Options will become enabled, and you may select the conditions upon which Data Logging is enabled. Single variable triggering, and an algebraic combination of two variables may be used to begin data acquisition. If data is to be saved to disk, you must select a logging file by pressing the appropriate button on the screen. A standard Windows dialog box will pop up and ask for filename and path data. Data may be saved anywhere on your computer's hard disk. Once the configuration is finished, it is recommended that you save your settings for future use. This is accomplished by pressing the yellow Save Configuration button on the screen. Again, a dialog box will appear, prompting you for a file name for this configuration. To get started running the configuration that you just created, press the Run Data Log button on the screen.

Running a CalMap Data Logging Session

After a configuration has been created or loaded, you are now ready to gather data from the ECM as it operates your engine. If you are not already in the Data Logging Environment, load it by pressing CTRL-L or selecting Data Logging -> Run -> Current Configuration from the CalMap menu bar. The Data Logging Virtual Stripchart is displayed on the screen, with the current variable names and values shown to the left of the grid. Data point information is displayed on the bottom of the screen and is updated once the logging session has actually been triggered. The logging file, if one has been selected, will be displayed in yellow text on the lower right side of the screen. If no file has been selected, <NONE> will be displayed. Before data has begun to be recorded, you are in the Data Logging Monitor Mode. The data values for the logging variables are updated in real time to the left of the screen, but data is not yet being recorded and/or graphed until the session has been triggered. If manual triggering has been enabled, simply press the ENTER key on the keyboard, or the Trigger button on the screen with your mouse, and data will begin to be saved. Note that data from sample rates higher than 10 samples/sec are not drawn on the screen in real-time mode. Data from these rates must be saved in a logging file, and viewed using the CalMap Data Analysis subsystem.

The CalMap Autolog Feature

CalMap has a built-in single keypress shortcut to load and execute the Data Logging subsystem called Autolog. To activate the Autolog feature, simply press the F5 key on the keyboard, or select Data Logging -> Run -> Autolog from the CalMap menu bar. The Data Logging subsystem will immediately load and be configured for the last selection that was saved as the Autolog configuration. Filenames will be based on the date and time of the logging session. Each file is named in the format MMDDYYYY_HHMMSS.LOG where MMDD represent the two-digit month and day, YYYY is the 4 digit year, and HHMMSS represent the time of day in hours, minutes, and seconds. Pressing the F5 key automatically begins a new logging session with the filename changed to the current time/date values.

In the Data Logging menu structure, there are 3 options allowing you to set the Autolog feature to Fuel, Ignition, or Other. Additionally, on the Data Logging Configuration Screen, there is a button labeled Make Autolog that will save the current configuration as the Autolog configuration.

Setting the Autolog Feature to Other

Selecting this option will bring up a standard dialog box prompting you for the Data Logging configuration that you would like to set up as the Auto-logging configuration. Any previously defined configuration may be used, just enter the appropriate filename and press the ENTER key, or press the Load button on the screen.

Using the CalMap Data Logging Analysis Subsystem

There are several options for analyzing data that was previously recorded using the CalMap Data Logging Subsystem.

- **Replay a Data Log Session:** This option will play back the selected Data Logging Session in real-time, just as it was recorded. Playback can be suspended, or single-stepped through to enable analysis of each individual data frame.
- **Graph a Data Log Session:** This option will graph the entire contents of a Data Logging Session at one time. The cursor arrow keys can be used to step back and forth across the data plot in order to allow very detailed analysis of the data.
- **Fueling Analysis:** This is a special mode, which requires that the first two logging variables be Engine Speed (RPM) and Manifold Pressure (%). The Base Volumetric Efficiency table is loaded, and the cell edit box indicates the operating points of the engine as it steps through the table during playback of a session. Changes to the volumetric efficiency data can be made during this data analysis session in order to aid in the tuning and calibration of an engine.
- **Ignition Analysis:** This is a special mode, which requires that the first two logging variables be Engine Speed (RPM) and Manifold Pressure (%). The Base Ignition Advance table is loaded, and the cell edit box indicates the operating points of the engine as it steps through the table during playback of a session. Changes to the

ignition timing data can be made during this data analysis session in order to aid in the tuning and calibration of an engine.

- **Air-to-Fuel Analysis:** This is a special mode, which requires that the first two logging variables be Engine Speed (RPM) and Manifold Pressure (%). The Target Air-to-Fuel Ratio table is loaded, and the cell edit box indicates the operating points of the engine as it steps through the table during playback of a session. Changes to the A:F ratio data can be made during this data analysis session in order to aid in the tuning and calibration of an engine.

Replaying a CalMap Data Logging Session

The CalMap Data Logging Analysis Replay subsystem can be accessed either via pressing CTRL-R on the keyboard, or selecting Data Logging -> Analyze Data -> Replay Session from the CalMap menu bar. A dialog box will appear prompting you to enter the name of the session that you want to replay. Enter the appropriate file and press ENTER or the Load button on the screen. A screen will be displayed that looks very similar to the Data Logging screen. Press the Play/Stop button to control the automatic playback of the session, or press the Step button to step through the session frame by frame. Once the analysis is complete, press the ESC key to exit the Data Logging Replay subsystem.

Graphing a CalMap Data Logging Session

The CalMap Data Logging Analysis Graphing subsystem can be accessed either via pressing CTRL-G on the keyboard, or selecting Data Logging -> Analyze Data -> Graph Session from the CalMap menu bar. A dialog box will appear prompting you to enter the name of the session that you want to plot. Enter the appropriate file and press ENTER or the Load button on the screen. A screen similar to that of the Replay Session will appear. Data is plotted from left to right, with the first 100 points shown on the first screen. If your session has more than 100 data points, you can press the << and >> buttons on the screen to scroll backward and forward on the plotted data. The left and right cursor arrow keys can be used to move the vertical yellow cursor around on the plots. The data values shown on the left side of the screen are accurate for the data at the yellow cursor bar. To overlay a second trace over the first trace and compare data values, press the button on the screen labeled Add Trace. A dialog box will appear, prompting you for the name of the second plot to add to the analysis. Enter the filename and press OK or the Enter key on the keyboard. The second trace is overlaid upon the first trace, and a new button on the screen appears with the label Toggle. Pressing the Toggle button switches the numeric data values between the first trace (indicated by a '1' next to the toggle button), the second trace (a '2' by the button), and the differences between traces 1 and 2 (indicated by a 'd' in the space next to the button). As before, the << >> buttons can be used to scroll through the data plots. Once your analysis is complete, press the ESC key to exit the Data Logging Replay Subsystem.

Performing a CalMap Fueling Analysis

The CalMap Data Log Fueling Analysis subsystem can be accessed either via pressing CTRL-F on the keyboard, or selecting Data Logging -> Analyze Data -> Fueling Analysis from the CalMap menu bar. A dialog box will appear prompting you to enter the name of the session that you want to analyze. Enter the appropriate file and press ENTER or the Load button on the screen. There will be a short pause while the Volumetric Efficiency data is read from the ECM, then a screen resembling the 16x16 table editing screen will be displayed. Immediately, the blue/yellow numeric cell edit box will begin tracing around the screen, showing the path that the engine took through the fueling map as your session progressed. Once playback of the entire session has completed, the buttons labeled << and >> may be used to step through the session, and data maybe changed as needed in the same manner as editing the actual Volumetric Efficiency table. Once your analysis is complete, press the ESC key to exit the Data Logging Fueling Analysis subsystem.

ECM CONFIGURATION

CONFIGURATION - SYSTEM

Number of Cylinders

When this value is changed the ECM must be turned off for no less than 20 seconds before the new setting is recognized. This is to protect against accidental changes while performing calibrations on a running engine.

Range: 4 to 8
Resolution: 1

Engine Displacement

When this value is changed the ECM must be turned off for no less than 20 seconds before the new setting is recognized. This is to protect against accidental changes while performing calibrations on a running engine.

Range: 55 to 825
Units: Cubic Inches
Resolution: 3.2

Ignition Delay

This value allows for the compensation of all of the ignition delays in the system. If the measured ignition advance tends to wander from the forced timing value commanded through CalMap as speed increases then this value needs to be modified. If the advance

becomes increasingly less than the total advance displayed on CalMap as engine speed increases then this value should be increased. If the advance becomes increasingly more than the total advance displayed on CalMap as engine speed increases then this value should be decreased.

For most applications, set this period to 100-125us. Press the F10 key to send the value to the ECM after it is entered. To adjust this table, start the engine and force the ignition timing by checking the forced timing box on the instrument screen. Next enter the ignition timing at the highest engine load, usually peak torque. Rev the motor approximately 1/2 of its maximum expected RPM, and check the timing variance between the forced value and the dampener reading. The value on the dampener should be the same as the value entered in the software across the entire RPM range. Raise or lower the number in this table to achieve this. A value of about 100-120 is recommended for a starting point.

Range: 0 to 999

Units: microseconds

Resolution: 4.0

Crank Index Offset

The ECM measures the ignition advance relative to the point where the crankshaft wheel passes the crankshaft pick-up. The ECM can not produce ignition advance angles less than where the pick-up/wheel position is established. The crankshaft pick-up can not be positioned after top-dead-center of compression.

It is recommended that the crankshaft wheel and pick-up be positioned to produce a pulse somewhere between 5 and 10 degrees before top-dead-center of compression. Once the wheel and pick-up are physically established the Index offset should be set to produce a match between the measured timing value and the total ignition advance value displayed on CalMap at 2000 RPM.

Range: 0 to 20

Units: crankshaft degrees

Resolution: 0.25

Compression Ratio

This value is the ratio of the pressure in the cylinder at TDC of compression to reference atmospheric pressure at sea level.

Range: 5 to 20

Units: ratio

Resolution: 0.059

Fuel Injector Rate

This value specifies the flow rate of the injector in pounds per hour. The injector flow rate is assumed to be rated at a 3 Bar (45 PSI) pressure. Most manufacturers specify flow rate of their injectors at this pressure. If the flow rate of the injector being used is rated at a pressure other than 3 Bar then apply the formula:

When pressure is specified in Bar
CIFR = MFR x square root of (3/MFP)

When pressure is specified in PSI
CIFR = MFR x square root of (45/MFP)

Where:

CIFR = Corrected injector flow rate to be entered

MFR = Manufacturers advertised injector flow rate.

MFP = Manufacturers pressure used to specify injector flow rate.

to calculate the pressure to be entered.

Range: 12 to 160

Units: pounds per hour

Resolution: 0.63

Fuel Rail Pressure

This value is the gauge pressure that is read when measuring the fuel rail pressure while the engine is not running. The pressure should be measured while the fuel pump is running and the engine is not. When the ignition is first switched on the fuel pump will run for 4 seconds. To measure the pressure switch the ignition on without cranking the engine and use the gauge reading that is present just prior to fuel pump turn off. This will give the best accuracy by allowing the fuel pressure to stabilize and not leak down once the pump is turned off.

Range: 0 to 120

Units: pounds per square inch (PSI)

Resolution: 0.47

Fully Closed TPS Sensor Setpoint -- Low Setpoint

This value specifies what the voltage of the throttle position sensor is when the throttle is fully closed. This value is used by the ECM to calculate Throttle opening percent. Throttle percentage is used for various calibration and control responses in the ECM. This value must be accurately entered in order for proper control operation. Refer also to the Fully Open TPS Voltage calibration value. Enter the value of the Throttle Position Sensor (TPS) voltage when the throttle is fully closed.

Range: 0 to 5.0

Units: Volts

Resolution: 0.0196

Fully Open TPS Sensor Setpoint -- High Setpoint

This value specifies what the voltage of the throttle position sensor is when the throttle is fully opened. This is used by the ECM to calculate throttle opening percent. Throttle percentage is used for various calibration and control responses in the ECM. This value

must be accurately entered in order for proper control operation. Refer also to the Fully Open TPS Voltage calibration value. Set this value while the ignition key is on and the engine is not running. Press the throttle to the floor and enter the Throttle Position Sensor (TPS) voltage.

Range: 0 to 5.0

Units: Volts

Resolution: 0.0196

Ignition Input/Output References

In order for the ECM to process spark and fuel timing properly, the ECM must recognize the signal waveforms from your cam and crank sensors. The ECM must also have the proper output to drive an ignition module or spark enhancer box. These reference switches should be adjusted, so that input or output, waveform type and signal edge, match the corresponding switch or table. Choose the preset ignition configuration that best suits your particular application. If none of the presets are exactly the combination that you need, pick the closest one, then select the 'Custom' preset. You will now be allowed to modify the individual ignition settings as needed. Always use an oscilloscope to verify these settings or refer to the Ignition chart in the installation section for your application. When any of these settings are altered, even through the use of the preset combinations, the ECM must be turned off for no less than 20 seconds before the new setting is recognized.

Map Configuration/Display Units

1, 2, or 3 Bar Map, or Alpha-N can be selected. If Alpha-N is selected, a 1 Bar Map range is assumed, and the Alpha-N, TPS vs. RPM table should be calibrated. You can also Select the type of units(% MAP, PSIA, or KPa) to have the MAP sensor reading displayed within CalMap when you are editing the individual ECM calibration tables.

Return or Returnless Fuel System

Select Return if the fuel pressure regulator is referenced to manifold vacuum. If the regulator is not referenced to manifold vacuum, or is mounted in the fuel tank, select returnless. In this mode of operation the ECM will automatically calculate the pressure differential across the injector.

Fuel Injector Firing Order

This table establishes the sequence in which your injectors will fire. To determine this sequence, identify the physical placement of each injector. Above each injector connector on the injector harness, there is a white identifying tab with a number. Match this number (1-8) to a corresponding number in your Injector Firing table. Always enter '1' as your first

number in this sequence, and list as many numbers as the number of cylinders in all modes, except for TBI. For example, a typical Chevrolet application would have an injector firing order of 18436572. Enter this number as a text string, with no spaces or hyphens. This table is interpreted differently for different fuel modes. In sequential fuel mode, the first component of the table will correspond to the first injector (1). This injector will fire after receiving a cam pulse. The important point is that you have all the numbers in the table filled out. For all multiple bank modes, TBI, Staggered Batch, and Staged Sequential injection, the sequence in the table will correspond to the primary and secondary banks. For example, in Staggered Batch mode, if you have a Chevrolet eight cylinder engine, the primary bank would have injectors 1-3-5-7, the secondary bank would have injectors 2-4-6-8. You would enter 13572468 in the Injector Firing Order table. The primary bank would consist of injectors 1-2-3-4, and the secondary bank would consist of 5-6-7-8. Enter in the table 12345678. In TBI mode, always assume a total of four injectors. The primary bank would have injectors 1-2, secondary bank would have injectors 3-4. Enter 12345678 in the table so that all injector locations are assigned within the ECM

NOTE: All 8 injectors must be accounted for in the firing order. This table must be accurate upon startup. It is up to the operator to ensure that the firing order configuration is valid. If this table is not accurate, complete, or valid, the ECM will not function properly, or the engine will not start.

Injection Type

Enter the fuel injection mode or strategy in which you want the injectors to fire:

In the *Sequential* injection mode, injectors fire once every two crank revolutions. A Cam input must be used to start the injector sequence accurately. The injectors fire in a predetermined order defined in the Injector Firing Order menu. Also in sequential mode, the injector timing can also be adjusted through the End of injector timing table in the fuel menu. All injectors must be the same size and there should always be one injector per cylinder.

In the *Staged Sequential* injection mode, injectors fire once every two crank revolutions. THIS MODE IS VALID FOR 4 CYLINDER ENGINES ONLY! The first 4 injectors will be fired as the primary set of injectors. After the TPS Sensor reading surpasses the value programmed in the TPS% Threshold field (if used), the second 4 injectors in your firing order will be enabled as a secondary bank of injectors. If the TPS threshold is not enabled, the secondary set of injectors will be engaged once the duty cycle of the primary injectors rises above 80%. A Cam input must be used to start the injector sequence accurately. The injectors fire in a predetermined order defined in the Injector Firing Order menu. Also in sequential mode, the injector timing can also be adjusted through the End of injector timing table in the fuel menu. All injectors must be the same size and there should always be one injector per cylinder.

In the *Staggered Batch* injection mode, no cam signal is needed. This method of injection is sometimes referred to as bank to bank injection. Each bank of injectors will fire once per crankshaft revolution, and will be out of phase 180 crankshaft degrees. For example, on an eight cylinder engine, referencing the Injector Firing Order table, the first four injectors listed will fire, then the second four will fire, 180* out of phase from the first bank. All injectors must be the same size and there should be one injector per cylinder.

The *TBI or Throttle Body* Injection strategy, fires each bank of injectors twice per crank revolution. Referencing the Injector Firing Order table, the order of primary and secondary bank firing will be determined. The primary bank will operate until the duty cycle reaches 80%. At this point the primary and secondary bank will begin to operate at half the rated duty cycle. This approach delivers a seamless transition of fueling between primary and secondary banks. As soon as duty cycle decreases below 30%, the secondary bank ceases to function and the primary bank takes over. This fueling scheme is very helpful when calibrating a progressive linkage throttle body. It decreases the circumstance of injecting fuel on a closed throttle butterfly, thereby lowering the chance of fuel puddling. This 'fuel puddling' phenomenon could cause the engine to misfire upon tip-in of the throttle. TBI mode does not require a cam signal and again, all injectors must be the same size.

The *Dual-Quad TBI* injection strategy is intended for TBI operation with 2 identical throttle bodies, with 2 sets of injectors (8 total)—Primary and Secondary—on each throttle body. This injection strategy will use the first 2 fuel injectors as the primary bank to fuel throttle body #1. Injectors 3 and 4 will be used as the secondary bank on throttle body #1. Injectors 5 and 6 will be used as the primary injectors on throttle body #2. Injectors 7 and 8 will be used as the secondary injectors on throttle body #2.

The secondary set of injectors on each throttle body will be enabled when the value specified in the TPS threshold table is exceeded (if enabled). If the TPS threshold function is not enabled, the secondary sets of injectors will be turned on when the primary injector duty cycle rises above 80%.

Note that in this configuration, only 1 Throttle Position Sensor and 1 Idle Air Controller are required.

CONFIGURATION – CONTROLS

Auxiliary Input Function -- 2-Step Limiter or IAC FeedFwd Request

Pin C on Accessories Connector, K3 on ECM Header.

When 2-Step is selected, rev limiting will commence at the value set in the Ignition Cut-Off Speed table ONLY when the ECM has an input signal higher than 6 volts at position K3

(Stage Input Line). If this input is grounded or floating, no 2-Step Rev Limiting will occur. When the switch is set for IAC Feed Forward Request, an active input signal on the Stage Input Line will result in the IAC Feed Forward Counts value being added to the current Idle Air Controller position in order to compensate for increased loading of the engine. Sequential ignition rev limiting is continuously active when operating in IAC Feed Forward Mode. Rev limiting will commence 100 RPM before the value set in the Ignition Cut-Off Speed table.

Default Ignition Cut-Off Speed

When the engine speed exceeds this value sparks begin to be eliminated. The number of sparks dropped is a function of how far above the rev limit value that the actual RPM is.

Range: 2000 to 12,750

Units: RPM

Resolution: 50

Default Fuel Cut-Off Speed

When the engine speed exceeds this value fuel will be turned off. It will be turned back on once the engine speed falls below the Default Fuel Restore Speed.

Range: 2000 to 12,750

Units: RPM

Resolution: 50

Default Fuel Restore Speed

Once the fuel is shut-off due to exceeding the engine speed specified for Fuel Cut-Off Speed, it will remain off until the engine speed falls below this value.

Range: 2000 to 12,750

Units: RPM

Resolution: 50

Exhaust Closed Loop Mode Enable

This master or global switch will enable or disable O2 feedback functions. When the switch is enabled or ON, the ECM will activate the parameters stored in all of the O2 related tables. Refer to these tables for further O2 feedback adjustments.

Exhaust Feedback Sensor Type

Two types O2 sensors will operate with your ECM. A HEGO sensor, which is a four-wire, heated unit, with a grounded signal input. This sensor will operate within a voltage range of 0 to 1 volt. Using this input, the ECM can adjust the fueling requirements to a set stoichiometric ratio. This ratio is preset at 14.5 to match the sensor. When the target A:F table is set to this Stoich ratio(14.5), and the other closed loop table parameters have

been satisfied, the ECU closed loop status function will become active. Secondly, a UEGO, linear, or wide band sensor can be used with the ECM. When selecting this mode of operation, a linear 'brick', or adapter box must be used in conjunction with the linear sensor. These parts are part of a linear, wide band kit that is available through your ACCEL dealer. When the ECM is in closed loop, the ECM will adjust the fueling requirements to meet the values set in the target A:F Ratio table.

Exhaust Feedback Processing Delay

The value in this table impacts the sample rate of the Exhaust Gas Oxygen Sensor input. Use this table like a low-pass filter to diminish the magnitude of responses to small changes on the oxygen sensor input signal, which smoothens the response of the fuel feedback system.

Wideband Oxygen Sensor Type

Select the type of Wideband Oxygen Sensor that you will be using with your system. Type 1 is the first wideband that was released with the DFI Gen 7 system, meant for normally aspirated applications only. It has a 5-wire harness connected to it, and is contained in a plastic shell. Type 2 refers to the second wideband package that was released with the DFI Gen 7+ system. This sensor has a 5-wire harness connected to it, and is contained in a metal shell. The extra 2 wires from the signal conditioner provide a scaled voltage output between 10.0 and 20.0 volts that can be read with any voltmeter. This Type 2 wideband supports operation on both normally aspirated and boosted applications.

O2 Strategy Adjustment

This switch will automatically adjust the Fuel Feedback control strategy (Proportional, Integral, and Differential Gain Controls) for the type of wideband oxygen sensor that you have selected, when you change your selection. If you haven't manually adjusted the Fuel PID gains, this switch should be set to the Automatic position. If you have done, or will be doing, some manual calibration to your Fuel Feedback PID gains, you should put the switch in the Manual position. If you have no idea what the Fuel Feedback PID Gain values do, please place this switch in the Automatic position.

Starting Prime Pulse

This function emulates the act of pumping the accelerator in a carburetor driven vehicle. When enabled, the accelerator must be pumped twice within 1 second in order to have additional fuel injected into the engine. The amount of fuel is set to be between 0% and 100% with the Magnitude slide bar control. Use this feature to help start your engine in cold weather conditions.

CONFIGURATION – OUTPUT OPTIONS

Auxiliary Output #1 Function -- AC Clutch Disable or VTEC Output

Pin B of Accessories Connector, G2 on ECM Header.

The AC Clutch disable output has multiple functions. If this select switch is in the AC Clutch Disable position, the output will be energized at the condition selected in the AC Clutch Disable Threshold control. If the switch is in the VTEC position, the output will be energized as a result of the conditions selected in the VTEC Control table.

AC Clutch Disable Threshold

When the throttle is opened more than this value the relay that connects the air conditioning clutch solenoid to its control source is energized. The relay is configured in the normally closed position so that when it is not energized normal air conditioning functions are maintained. Once the relay is energized it will not be turned off until the throttle falls below 10% of the disable threshold value for 5 Seconds.

A value of 90% is recommended.

Range: 0 to 100

Units: % Throttle Position

Resolution: 0.392

VTEC Functionality

Use this table to control the exact engine operating point at which the Auxiliary output is energized. It is only meaningful when the Auxiliary Output Function is set to the VTEC Control position. Engine Speed, Throttle Position Sensor %, and Manifold Absolute Pressure % can be used individually, or as a group to define the exact engine operating points at which the Auxiliary Output Relay is energized.

To use one or more of these items in the control loop, place a checkbox in the ENABLED column for the desired parameters. Then enter the value at which you want the ENABLE condition to be satisfied at in the ENABLE column.

Next, enter the value at which you want the DISABLE condition to be satisfied in the DISABLE column. Press F10 to send these changes to the ECM.

For example: To use only Engine Speed to control the output, check the topmost box in the ENABLED column, enter 4000 into the ENABLE column, and enter 3500 in the DISABLE column. This will cause the VTEC output to become active when engine speed rises above 4000 RPM, and remain active until the engine speed drops below 3500 rpm. This creates a control hysteresis of 500 RPM, which is the difference between the ENABLE (On) value, and the DISABLE (Off) value.

For MAP% only, the direction of the control hysteresis may be specified. For example, if the MAP settings are as follows: Enable: 40.0%, Disable: 30.0%, Active Above High Setpoint; the MAP condition will be satisfied when the MAP sensor value rises above 40% and remains active until the sensor reading drops below 30%.

However, if the Active State is set to “Below Low Setpoint”, the MAP condition will become active when the sensor reading drops below the value in the ENABLE column, and remains active until the sensor reading rises above the value in the DISABLE column.

The “Below Low Setpoint” setting causes the control strategy to look for a change in the MAP sensor reading in a descending direction. Because of the descending direction, the Enable value becomes the low setpoint value, and the disable value becomes the high setpoint value. This means that the Enable value must be lower than the disable value. The values in the ENABLE and DISABLE column will have to be reset to achieve the desired behavior, since the ENABLE value must be lower than the DISABLE value when the Active State is set to “Below Low Setpoint” for MAP% control only.

Auxiliary Output #2 Function -- Shift Light Output or Fan #2 Control

White Flying Lead, J3 on ECM Header.

Use this switch to choose between 2 functions for the Shift Light Output line on the ECM. Put the switch in the Shift Light position to enable the output to be activated at the engine speed specified in the Shift Output RPM table. Select the Fan 2 Control position to use the output as a control line for a second cooling fan relay. The output will then be controlled by the values specified in the Fan 2 ON and Fan 2 OFF fields. Use the Shift light Output/Fan 2 Control Select to customize the operation of your DFI ECM to the specific requirements of your application. Note that this is an ACTIVE LOW (Grounded) circuit that will be pulled to ground internally when activated.

Shift Light Threshold

This is the engine speed, in RPM, that the shift light output is turned on. When engine speed falls below this value the output is turned off.

Range: 0 to 12000

Units: RPM

Resolution: 50

Fan On Temperature

This is the temperature, as sensed by the engine coolant temperature sensor, that the fan relay is energized. Note that this value must be greater than 150 degrees. A value of 205 F is recommended.

Range: 150 to 250

Units: Degrees Fahrenheit

Resolution: 1.2

Fan Off Temperature

This is the temperature, as sensed by the engine coolant temperature sensor that the fan relay is turned off. Note that this value must be greater than 150 degrees. A value of 185 F is recommended.

Range: 150 to 250

Units: Degrees Fahrenheit

Resolution: 1.2

Fan IAC Feed Forward Counts

Idle Air Controller Feed Forward Counts are additional steps that are added to the position of the Idle Air Controller to compensate for known load changes as they are imposed upon the engine. The number entered into this table will be added to the current position of the Idle Air Controller when the associated fan output is activated. Use this table to eliminate variations in idle speed that may result from the additional loading of the engine caused by activating the fan(s).

AC Request Input Turns Fan 1 On

When enabled, this function will automatically activate the output for Fan #1 when the Air Condition Request Input is activated. Select 'Yes' to have the output for fan 1 automatically activated when the AC Request input is activated. Use this feature to cause your Generation 7 DFI ECM to emulate the behavior of a typical OEM engine control strategy.

CONFIGURATION - TORQUE CONVERTER

Pin A on Accessories Connector = TCC Lockup Output, Active Low.

Performance Mode

When this table is activated, the TCC relay is energized under all conditions. Note: Due to certain mechanical conditions, in some transmissions, TCC will not engage in first gear even though the relay is energized.

4th Gear Indicator Signal

Pin D on Accessories Connector, Active Low.

Enter the status, 12 volts (high), or 0 volts (low), of the 4th gear signal from the transmission. The output from the transmission will be active in 4th gear only.

TCC Minimum (%) Throttle Position

Once the torque converter clutch (TCC) relay is energized, if the throttle falls below this value, the TCC relay will be turned off.

A starting value of approximately 5% is suggested.

Range: 0 to 100

Units: % of Total Throttle Range

Resolution: 0.392

TCC Maximum (%) Throttle Position

When in the normal Torque Converter Clutch (TCC) control mode the throttle must be opened more than this value, the engine speed must be over some minimum RPM, the coolant temperature must be over 120 degrees F and 4th gear is sensed to activate the TCC relay. Once the relay is energized it will not turn off until the speed drops below a minimum level or the throttle exceeds the TCC WOT throttle level or the throttle falls below the minimum TCC throttle level or 4th gear is no longer active.

A starting value of approximately 10% is suggested.

Range: 0 to 100

Units: % of Total Throttle Range

Resolution: 0.392

TCC Minimum RPM

Once the torque converter clutch (TCC) relay is energized, if the engine speed falls below this value, the TCC relay will be turned off.

A starting value of approximately 1500 RPPM is suggested.

Range: 0 to 12,000

Units: RPM

Resolution: 50

TCC Maximum RPM

When in the normal Torque Converter Clutch (TCC) control mode the engine speed must be greater than this value, the throttle position must be over some minimum opening, the coolant temperature must be over 120 degrees F and 4th gear is sensed to activate the TCC relay. Once the relay is energized it will not turn off until the speed drops below a minimum level or the throttle exceeds the TCC WOT throttle level or the throttle falls below the minimum TCC throttle level or 4th gear is no longer active.

A starting value of approximately 2500-RPM is suggested.

Range: 0 to 12,000

Units: RPM

Resolution: 50

TCC Wide Open Throttle Unlock - (%) Throttle Position

When in the normal torque converter clutch control mode when the throttle exceeds this value the torque converter clutch (TCC) control relay is turned off. The relay will remain off for the amount of time specified by the TCC WOT Unlock Period. The relay will be energized again after the WOT unlock period if the engine speed and throttle position are over their respective thresholds and 4th gear is still active.

A starting value of approximately 90% is suggested.

Range: 0 to 100

Units: % of Total Throttle Range

Resolution: 0.392

TCC Exit Wide Open Throttle Unlock – (%) Throttle Position

When in the normal torque converter clutch (TCC) control mode the torque converter clutch relay is turned off for some amount of time when over the WOT Unlock TCC Throttle value. The TCC control strategy reverts back to normal cruise TCC control mode when the throttle is below this value.

A starting value of approximately 70% is suggested.

Range: 0 to 100

Units: % of Total Throttle Range

Resolution: 0.392

TCC Wide Open Throttle Unlock Period (seconds)

When in the normal torque converter clutch (TCC) control mode the torque converter clutch relay is turned off for this amount of time when over the WOT Unlock TCC Throttle value. The TCC control relay will be turned back on once this time has elapsed and the engine speed and the throttle and engine speed is over their respective minimum amounts and 4th gear is active.

A starting value of approximately 5 Seconds is suggested.

Range: 0 to 40

Units: Seconds

Resolution: 0.16

TORQUE CONVERTER – TCC DELAY

TCC Load Delay

The values in this table specify the amount of time that the ECM will wait to activate the torque converter clutch control relay after all of the conditions are satisfied to require its activation (Refer to TCC RPM and TPS threshold tables and TCC configurations). The

manifold pressure is used as an index into this table. The amount of time to delay the converter lock is selected based on the value of the intake manifold pressure.

Index: Manifold Absolute Pressure

Range: 0 to 40.8

Units: Seconds

Resolution: 0.16

CONFIGURATION - SENSOR MEASUREMENTS

Ignition Voltage Filter Rate (Pro Version only)

The ECM is connected to the ignition voltage. The ECM strategy employs a filtering algorithm that works to smooth the signal and eliminate noise. The cleaner this signal is the more reliable the results of the ECM control strategy are.

The ignition voltage is used to determine a variety of correction factors for some of the control functions. It is also used to determine when the ignition switch is turned on/off. This value establishes how much the voltage signal is filtered. The larger the value the slower the signal looks to the control strategy. Smaller values allow the ECM to recognize the signal quicker but also allow more noise to be passed as well. A value of approximately 50 is recommended.

Range: 9 to 900

Units: milliseconds

Resolution: varies from 4 to 400 (logarithmic function)

Throttle Position Filter Rate (Pro Version only)

The ECM is connected to a throttle position sensor (TPS). The ECM strategy employs a filtering algorithm that works to smooth the sensor's signal and eliminate noise. The cleaner this signal is the more reliable the results of the ECM control strategy are.

The throttle position is used by the ECM strategy to determine a number of fueling, NOS, torque converter, fan, air conditioning clutch and idle control responses. This value establishes how much the throttle position signal is filtered. The larger the value the slower the signal looks to the control strategy. Smaller values allow the ECM to recognize the signal quicker but also allow more noise to be passed as well. A value of approximately 20 is recommended.

Range: 9 to 900

Units: milliseconds

Resolution: varies from 4 to 400 (logarithmic function)

Manifold Pressure Filter Rate (Pro Version only)

The ECM is connected to an intake manifold absolute pressure sensor (MAP). The ECM strategy employs a filtering algorithm that works to smooth the sensor's signal and

eliminate noise. The cleaner this signal is the more reliable the results of the ECM control strategy are.

The manifold pressure is used by the ECM strategy to determine a number of fueling, ignition and torque converter control responses. This value establishes how much the manifold pressure signal is filtered. The larger the value the slower the signal looks to the control strategy. Smaller values allow the ECM to recognize the signal quicker but also allow more noise to be passed as well. A value of approximately 20 is recommended.

Range: 9 to 900

Units: milliseconds

Resolution: varies from 4 to 400 (logarithmic function)

Atmospheric Pressure Filter Rate (Pro Version only)

The ECM is connected to an atmospheric pressure sensor. The ECM strategy employs a filtering algorithm that works to smooth the sensor's signal and eliminate noise. The cleaner this signal is the more reliable the results of the ECM control strategy are.

The atmospheric pressure is used by the ECM strategy to determine a number of fueling and ignition control responses. This value establishes how much the atmospheric pressure signal is filtered. The larger the value the slower the signal looks to the control strategy. Smaller values allow the ECM to recognize the signal quicker but also allow more noise to be passed as well. A value of approximately 150 is recommended.

Range: 9 to 900

Units: milliseconds

Resolution: varies from 4 to 400 (logarithmic function)

Engine Temperature Sensor Filter Rate (Pro Version only)

The ECM is connected to an engine coolant temperature sensor (ECT). The ECM strategy employs a filtering algorithm that works to smooth the sensor's signal and eliminate noise. The cleaner this signal is the more reliable the results of the ECM control strategy are.

The coolant temperature is used by the ECM strategy to determine a number of fueling, ignition, torque converter and fan control responses. This sensor is also used for estimating the intake port temperature. This value establishes how much the coolant temperature sensor signal is filtered. The larger the value the slower the signal looks to the control strategy. Smaller values allow the ECM to recognize the signal quicker but also allow more noise to be passed as well. A value of approximately 150 is recommended.

Range: 9 to 900

Units: milliseconds

Resolution: varies from 4 to 400 (logarithmic function)

Intake Air Temperature Sensor Filter Rate (Pro Version only)

The ECM is connected to an intake air temperature sensor (IAT). The ECM strategy employs a filtering algorithm that works to smooth the sensor's signal and eliminate noise. The cleaner this signal is the more reliable the results of the ECM control strategy are.

The intake air temperature is used by the ECM strategy to determine a number of fueling and ignition control responses. This sensor is also used for estimating the intake port temperature. This value establishes how much the intake air temperature sensor signal is filtered. The larger the value the slower the signal looks to the control strategy. Smaller values allow the ECM to recognize the signal quicker but also allow more noise to be passed as well. A value of approximately 150 is recommended.

Range: 9 to 900
Units: milliseconds
Resolution: varies from 4 to 400 (logarithmic function)

Manifold Surface Temperature Sensor Filter Rate (Pro Version only)

The ECM is connected to an intake manifold skin/surface temperature sensor (MST). The ECM strategy employs a filtering algorithm that works to smooth the sensor's signal and eliminate noise. The cleaner this signal is the more reliable the results of the ECM control strategy are.

The manifold surface temperature is used along with the engine coolant and intake air temperature by the ECM strategy to calculate the intake port temperature. This value establishes how much the manifold surface temperature sensor signal is filtered. The larger the value the slower the signal looks to the control strategy. Smaller values allow the ECM to recognize the signal quicker but also allow more noise to be passed as well. A value of approximately 150 is recommended.

Range: 9 to 900
Units: milliseconds
Resolution: varies from 4 to 400 (logarithmic function)

HEGO/UEGO Filter Rate

The ECM can be connected to either a Heated Exhaust Gas Oxygen (HEGO) sensor or a Universal Exhaust Oxygen (UEGO) sensor-conditioning module. Both sensors measure oxygen levels in the exhaust. Exhaust oxygen content in turn is proportional to the air to fuel ratio of combustion. The ECM strategy employs a filtering algorithm that works to smooth the sensor's signal and eliminate noise. The cleaner this signal is the more reliable the results of the ECM control strategy are.

The exhaust oxygen sensor is used by the ECM strategy to determine a number of fueling control responses. This value establishes how much the exhaust oxygen sensor signal is filtered. The larger the value the slower the signal looks to the control strategy. Smaller values allow the ECM to recognize the signal quicker but also allow more noise to be passed as well. This table allows the user to modify the response as a function of mass air flow. Generally, the values would be low at low levels of mass air flow, with increasing response as mass air flow increases.

Range: 9 to 1048
Units: milliseconds
Resolution: varies from 4 to 400 (logarithmic function)

DIAGNOSTICS MENU

Engine Status Monitor

This screen offers a general overview of many critical operating parameters that is updated in real-time, as the engine operating point changes. The read-only values displayed on the screen are described below.



Engine Status Monitor

Cylinder Fuel Coefficients: Cylinders 1-8.

This is the amount of correction that is being applied to the current fueling strategy for each individual cylinder based on the associated individual cylinder correction fueling tables in the ECM calibration strategy. A value above 1.0 indicates that fuel is being added to the current fueling strategy in order to correct to the given target air to fuel ratio as selected in the Target Air to Fuel ratio calibration table. A value below 1.0 indicates that fuel is being subtracted from the current fueling strategy to correct to the current air to fuel ratio.

Fueling Parameters: These are various corrections that are applied to the fueling strategy in the ECM based on current operating points.

Patm Ve Coef: Correction applied to the current Base VE value based on the current measured atmospheric pressure.

Est. IPT Ve Coef: Correction applied to the current Base VE value based on the current estimated intake port temperature value.

Tot. ECT Ve Cor: Total correction applied to the current Base Ve value based on the current engine coolant temperature sensor value.

AftSrt Fuel Coef: Correction applied to the current fueling strategy based on elapsed time since the engine was started.

INJ PW VT: Correction applied to the fuel injector pulse with value based on the current measured ignition voltage value.

Tot Fuel Rate: Total amount of fuel being delivered to the engine in units of pounds per hour.

Target A:F: Current target air to fuel ratio as specified in the target air to fuel ratio calibration table.

Ignition Terms: The amount of timing that is added/subtracted from the base value based on current operating conditions.

IGN ECT Adv: Timing adjustment based on the current engine coolant temperature sensor value.

Startup Advance: Additional degrees of timing added based on elapsed time since the engine was started.

Idlespark Adv: Additional degrees of timing added based on the current idle control strategy.

Knock Retard: Degrees of timing currently being subtracted based on the detection of a knock condition by the knock sensor.

IGN IPT Adv: Additional degrees of timing added based on the current estimated intake port air temperature.

NOS Advance: Timing adjustments based on the current state of the Nitrous Oxide control strategy and NOS retard tables.

Nitrous Oxide System Status: Estimated and actual NOS fueling values based on current engine operating points.

NOS Fuel Rate: Most recent rate of NOS fuel delivered to the engine based on the current NOS control strategy, in pounds per hour.

Stage Status: Displays “Disabled”, “Ready”, or “Active” based on the current NOS stage enable setting from the configuration screens.

Calculated Fuel: CALCULATED amount of NOS fuel that WOULD BE DELIVERED to the engine IF the current stage was active.

Trim Only: CALCULATED amount of NOS Trim fuel that WOULD BE DELIVERED to the engine IF the current stage was active.

Estimated HP: Estimated horsepower gain achieved by the engine if the calculated amounts of NOS fuel were delivered to the engine.

Input Diagnostics

The Input Diagnostics Screen (CTRL-D) contains simulated LED displays for the cam and crank signal inputs. The LEDs will change state when cam and crank inputs to the ECM change state. The crank signal is toggled so that it is active every other crank tooth, but actually changes state on every crank tooth. The cam LED is lit from when cam signal first becomes active, through the next crank event in order to make it more useful. Also included are numeric displays for Engine Coolant Temperature, Intake Air Temperature, Manifold Surface Temperature, and Throttle Position Sensor.

Note that the LED displays will only be useful during cranking, and at very low operating speeds. Due to varying sampling rates, the sequence of the LEDs may appear not to be correct at higher engine RPMs. This is because it is not possible to update the screen as quickly as the cam and crank input lines change state at higher engine speeds.

Clear Error Codes

This menu selection will bring up a list of current error codes generated by the ECM. A brief explanation of each code is present, and all of the codes can be cleared at once from this screen by clicking on the ‘Acknowledge and Clear’ button. For an ECM with firmware revision 3.2 or higher, you can also enable/disable individual error codes by selecting the ‘Enable/Disable’ button from the error codes screen.

View Error Codes

This menu item loads a list of all possible error codes that can be generated by the ECM. No information on current error codes residing in the ECM is displayed here.

Establish Communication

This menu selection (F9) will attempt to re-establish communications with the ECM in the event of any kind of communication system failure. If no communication with the ECM can be maintained, there may be a problem with your computer, cables, or the ECM. If the ECM is changed after experiencing a communication failure, you must re-establish communications through the splash screen, Edit Data from ECM.

HELP MENU

About CalMap

This menu item brings up the CalMap splash screen and identification data about the program.

Calibration Tool Help

This menu item loads the CalMap ONLINE Help subsystem. Detailed context-specific help information is also available from any screen within CalMap by pressing the F1 key.

Drawings/Schematics

This menu item loads the CalMap ONLINE Drawings subsystem. It is also accessible by pressing the CTRL and F1 keys from anywhere within CalMap. See the following section for some of the available drawings and wire lists.

View Access Privileges

If you are working with a password-protected calibration, this menu item will display the list of screens and calibration tables that are accessible.

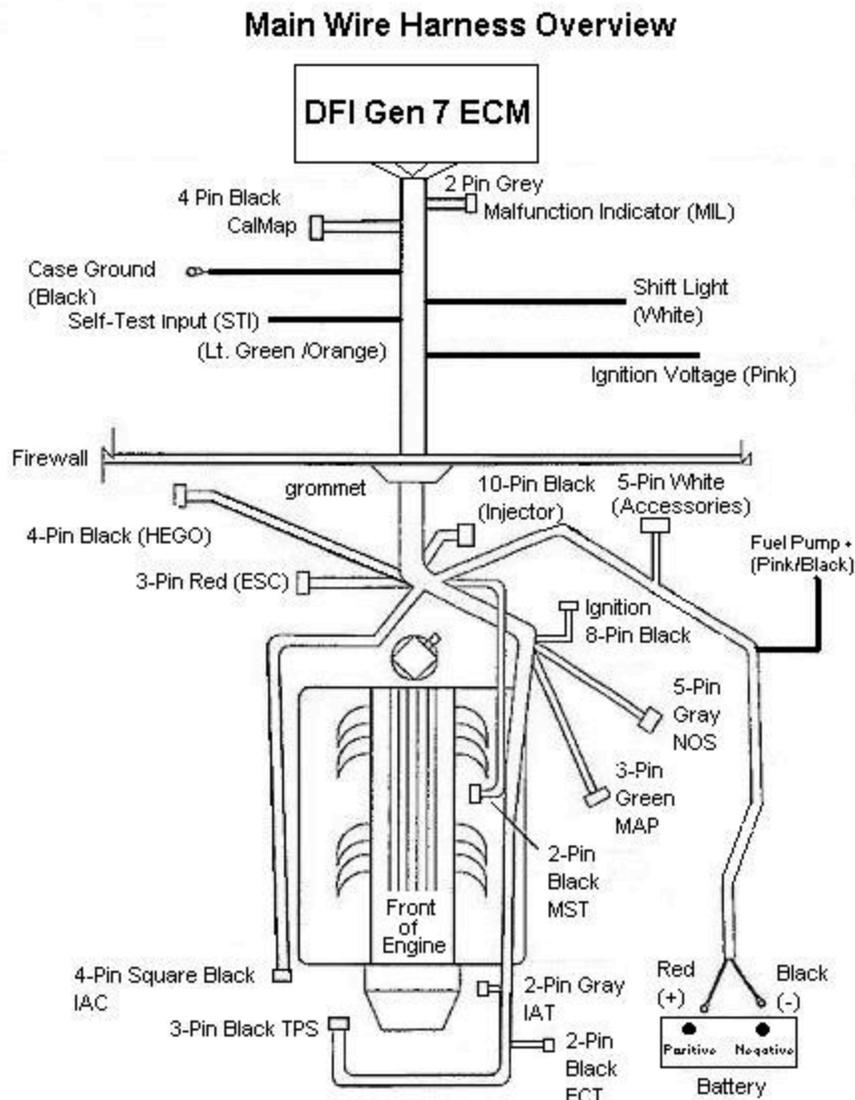
Keyboard Shortcuts

This menu item will display a printable listing of all the available shortcut key commands. See the keyboard shortcuts section in this manual for details.

Wire List and Wiring Harness Overviews

The following wiring harnesses diagrams and wire lists are taken from the CalMap Online Drawings and Wiring Diagrams. You can access these drawings by pressing the Control and F1 keys (CTRL-F1) from anywhere within the DFI CalMap calibration software, or by selecting the "Drawings/Schematics" item from the Help menu.

Main Wire Harness Overview



ECM Header Main Wire List

Page 1

CIRCUIT	GAGE	GOES TO	COLOR	NOTES
P1-E1-2	20	TPS-C	GRY/WHT	TPS +5VP
P1-B1	20	TPS-B	BRN	TPS SIGNAL
P1-E2-4	20	TPS-A	GRY/RED	TPS RTN
P1-E1-1	20	MAP-C	GRY/WHT	MAP +5VP
P1-A1	20	MAP-B	LT GRN	MAP SIGNAL
P1-E2-1	20	MAP-A	GRY/RED	MAP RTN
P1-Y2	20	INJ-H	ORG	INJ-1
P1-W2	20	INJ-D	GREY	INJ-2
P1-T2	20	INJ-B	DK GRN	INJ-3
P1-S2	20	INJ-G	YEL/RED	INJ-4
P1-X1	20	INJ-C	YEL/BLU	INJ-5
P1-W1	20	INJ-A	DK BLU/PNK	INJ-6
P1-T1	20	INJ-J	DK BLU/ORG	INJ-7
P1-S1	20	INJ-K	DK BLU/YEL	INJ-8
R2-1-2	18	INJ-E	PINK	+12V SWITCHED
R2-1-3	18	INJ-F	PINK	+12V SWITCHED
P1-Y1	18	SPLICE #7	BLACK	GROUND
P1-M1-2	14	BATTERY +	RED	+12V BATT
P1-M1	18	SPLICE #4	RED	+12V BATT
P1-P2	20	WC-A	BRN/WHT	A HIGH
P1-R2	20	WC-C	BRN/YEL	B HIGH
P1-P1	20	WC-B	YEL/BLK	A LOW
P1-R1	20	WC-D	PURP/YEL	B LOW
P1-E2-3	20	ECT-A	GRY/RED	ECT RETURN
P1-C1	20	ECT-B	TAN	ECT SIGNAL
P1-E2-2	20	IAT-A	GRY/RED	IAT RETURN
P1-D1	20	IAT-B	TAN/WHT	IAT SIGNAL
P1-J2	20	SPLICE #8	DK BLU/WHT	RETURN
P1-Y1-1	20	RELAY 1	BLACK	GROUND
R2-1-5	20	MIL-A	PINK	+12V SW
P1-M1-1	20	RELAY 2	RED	+12V BATT
P1-D2	20	MST-A	LT BLU	MST SIGNAL
P1-E2-5	20	MST-B	GRY/RED	MST RETURN
P1-Y1-2	18	RELAY 2	BLACK	GROUND
R2-1	14	SPLICE #1	RED/WHT	+12V SW
R2-1-4	18	HEGO-D	PINK	+12V SWITCHED

P1-C3	20	IGN-F	DK GRN/WHT	CAM+
P1-D3	20	IGN-E	DK GRN/YEL	CAM-
P1-L1	20	HEGO-B	PINK/BLU	SIGNAL
P1-L3	18	SPLICE #3	PINK	+12V SWITCHED
P1-L3-1	18	FLYING LEAD	PINK	+12V SW
P1-L3-2	18	RELAY 1	PINK	+12V SW
P1-N1	20	CALMAP B	LT BLU/WHT	DLC+
R2-1-B	16	IGN-A	PINK	+12V SW
P1-K2	20	IGN-H	DK BLUE	EST
P1-K1	20	IGN-B	WHITE	BYPASS
P1-Y1-3	18	HEGO-C	BLACK	GROUND
P1-Y1-4	14	BATTERY -	BLACK	GROUND
P1-H1	20	ESC-B	PURPLE	ESC SIGNAL
P1-E2	20	SPLICE #5	GRY/RED	SIGNAL RETURN
P1-N3	20	HEGO-A	BLK/WHT	HEGO SIG. RTN
P1-T3	20	NOS-A	LT BLU/ORG	SOLENOID #1
P1-W3	20	NOS-B	LT GRN/YEL	SOLENOID #2
P1-L2	20	NOS-C	LT GRN/BLK	NOS ENABLE 1
P1-J1	20	NOS-D	LT GRN/RED	NOS ENABLE 2
P1-E1	20	SPLICE #2	GRY/WHT	+5Vr
P1-B3	20	IGN-C	TAN/BLK	CRK-
P1-A3	20	IGN-D	TAN/BLUE	CRK+
P1-P3	20	MIL-B	WHT/BLK	MIL LIGHT
R1	14	BATTERY +	RED	+12V BATT
R1-1	14	FUEL PUMP +	RED/BLK	+12V
P1-N2	20	CALMAP-A	LT BLU/BLK	DLC-
P1-H2	20	ACCESSORY-A	LT BLU/YEL	TCC RELAY
P1-G2	20	ACCESSORY-B	YEL/LT BLU	ACC RELAY
P1-K3	20	ACCESSORY-C	YEL/GRN	STAGE
P1-G3	20	ACCESSORY-D	LT BLU/PNK	4TH GEAR
P1-R3	20	ACCESSORY-E	TAN/YEL	FAN RELAY
P1-M2	20	FLYING LEAD	LT GRN/ORG	STI
P1-S3	20	RELAY 1	PNK/BLK	FPR
P1-X3	18	FLYING LEAD	BLACK	CASE GROUND
P1-Y2	18	BATTERY -	BLACK	GROUND
P1-Y1-6	18	ESC-C	BLACK	GROUND
P1-L3-3	18	ESC-A	PINK	+12V IGN.
P1-L3-4	18	NOS-E	PINK	+12V IGN.
P1-M3	20	CALMAP D	PINK	+12V IGN.
P1-J3	20	FLYING LEAD	WHITE	SHIFT LIGHT
P1-J2-1	20	CALMAP-C	DK BLU/WHT	RETURN
P1-K1-1	20	IGN-B	WHITE	BYPASS
P1-Y1-5	14	SPLICE #B,7	BLACK	JUMPER

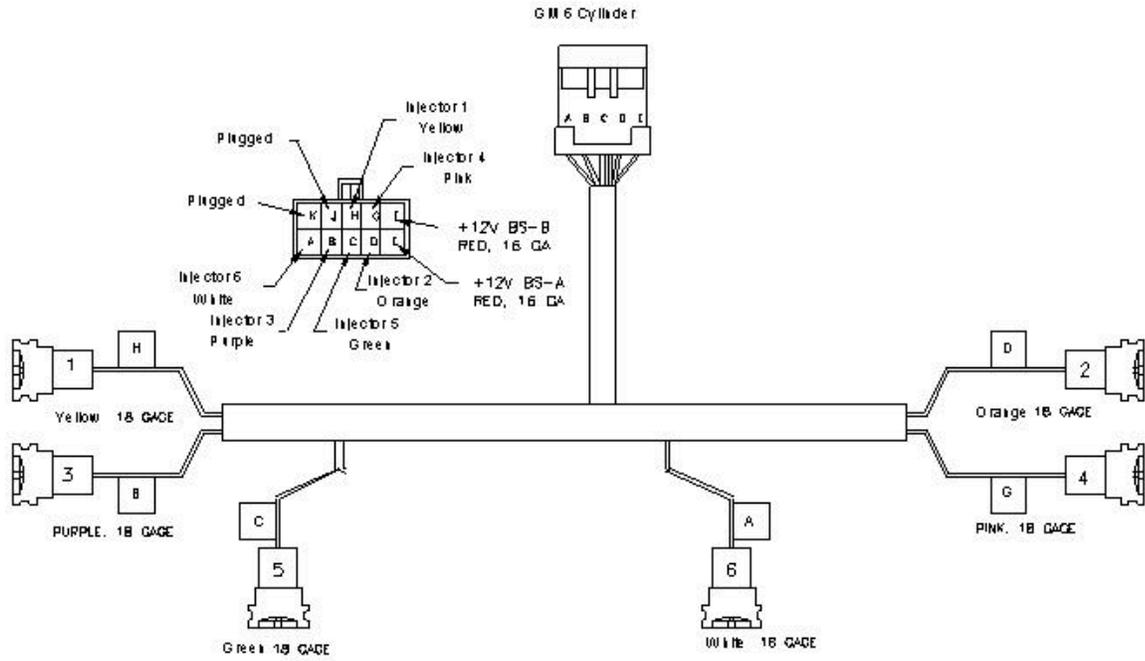
Cylinder Position Wire Listing / Firing Orders

Typical Firing Orders

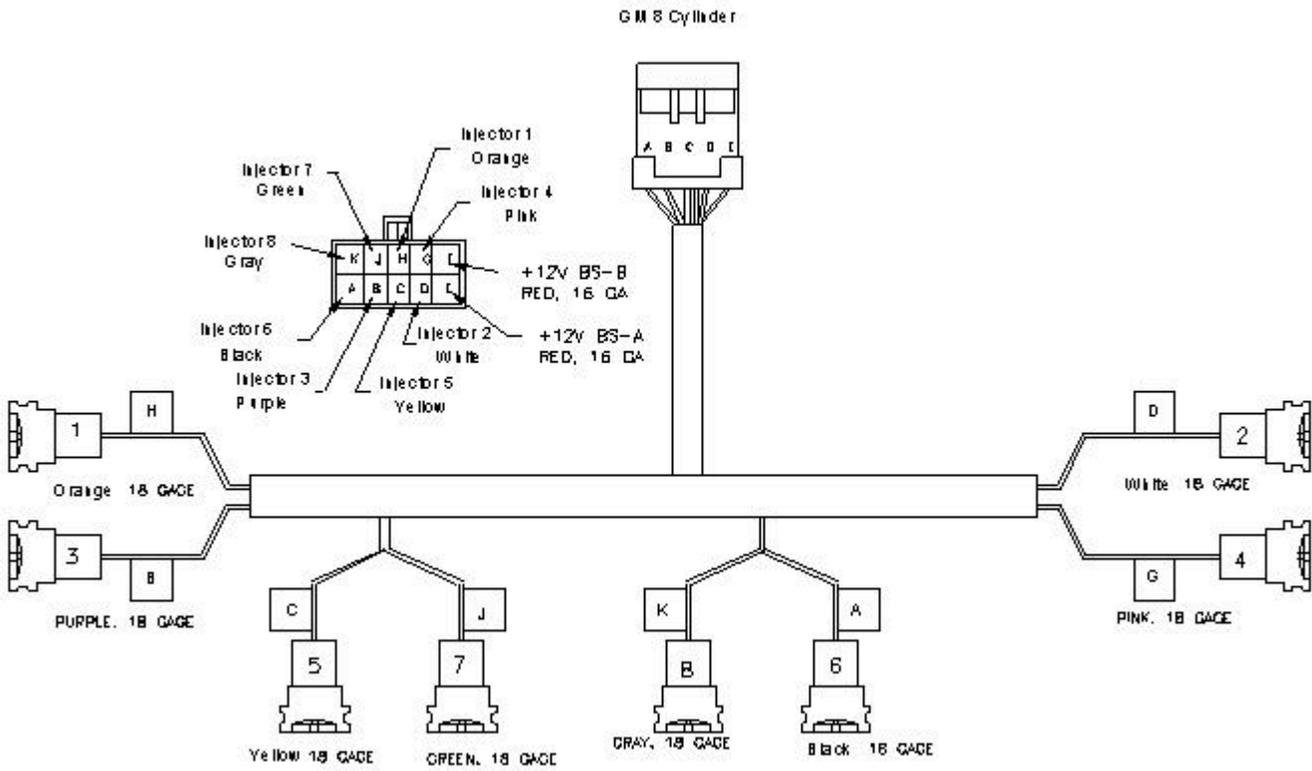
Software Table	Engine Placement	10-way connector	ECM Header Pinout
Injector #1	Cylinder #1	H	X2
Injector #2	Cylinder #2	D	W2
Injector #3	Cylinder #3	B	T2
Injector #4	Cylinder #4	G	S2
Injector #5	Cylinder #5	C	X1
Injector #6	Cylinder #6	A	W1
Injector #7	Cylinder #7	J	T1
Injector #8	Cylinder #8	K	S1

Chevrolet	Chevrolet (ProStock)	Ford	Ford (Windsor)	Buick 6-cyl.	4-cyl
1	1	1	1	1	1
8	8	5	3	6	3
4	7	4	7	5	4
3	3	2	2	4	2
6	6	6	6	3	x
5	5	3	5	2	x
7	4	7	4	x	x
2	2	8	8	x	x

GM 6 Cylinder Injector Harness

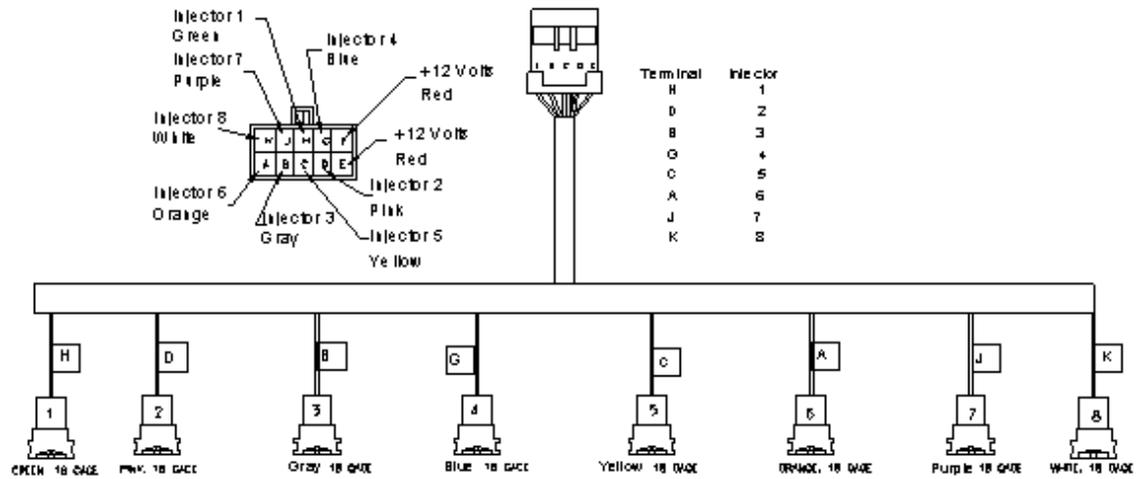


GM 8 Cylinder Injector Harness



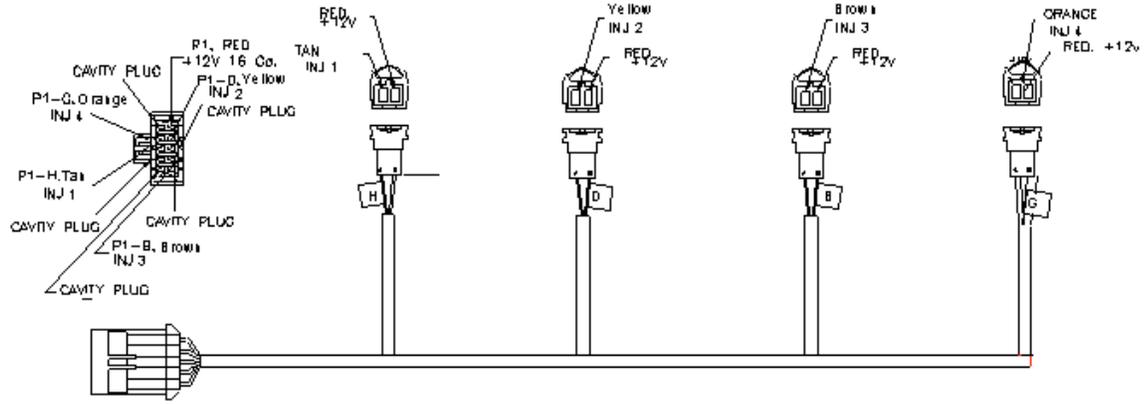
Ford 8-Cylinder Injector Harness

Ford 8 Cylinder



Honda 4 Cylinder Injector Harness

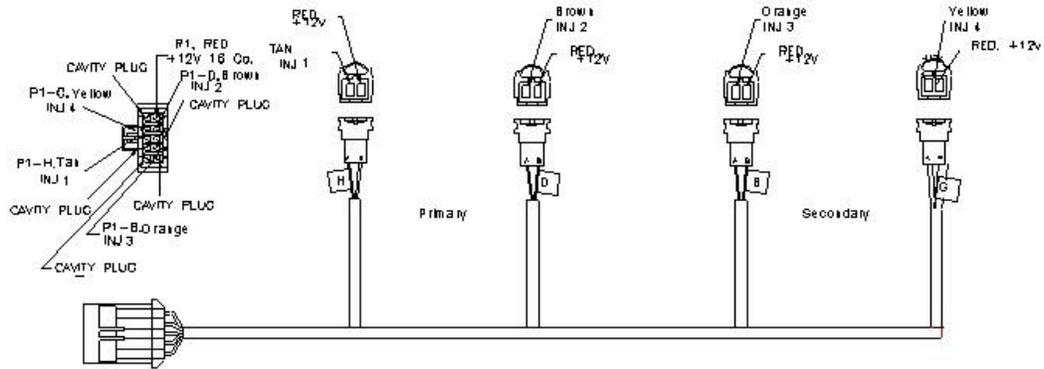
Honda 4 Cylinder



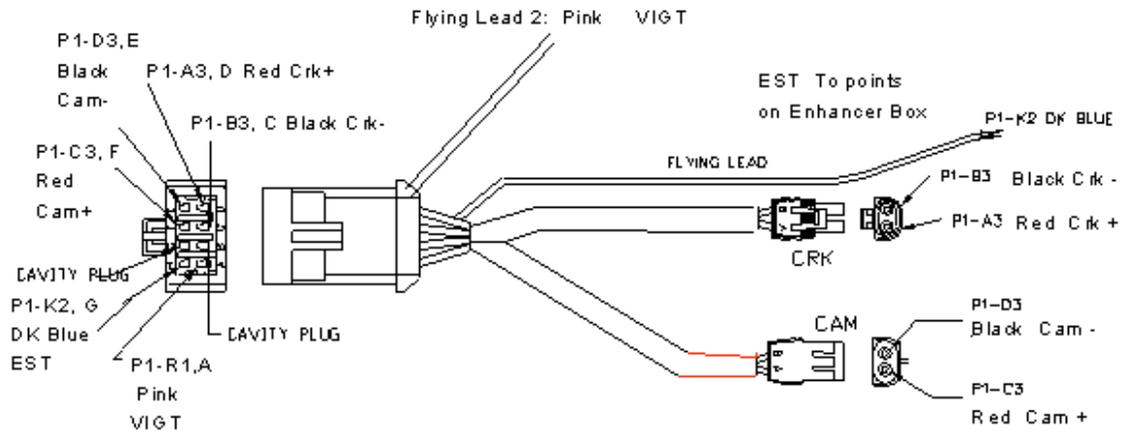
TBI Injector Harness

Throttle Body Injection

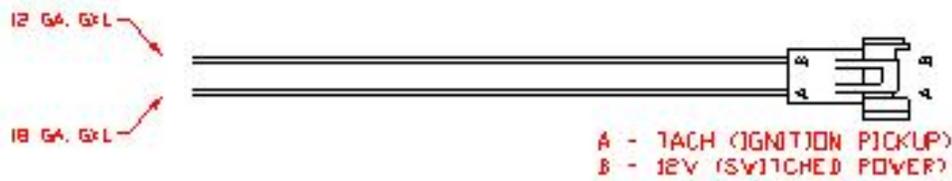
Terminal	Injector
H	1
D	2
B	3
G	4



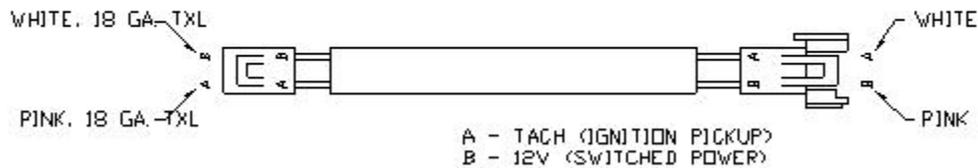
Universal SEFI IPU Ignition Harness



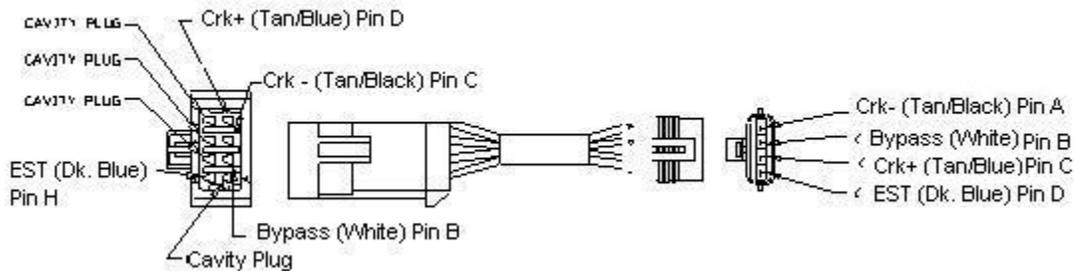
F-Body Coil Power Harness



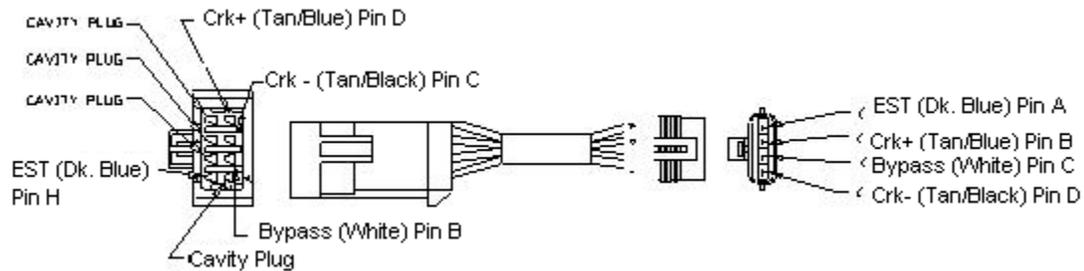
F-Body Distributor Coil Adapter Harness



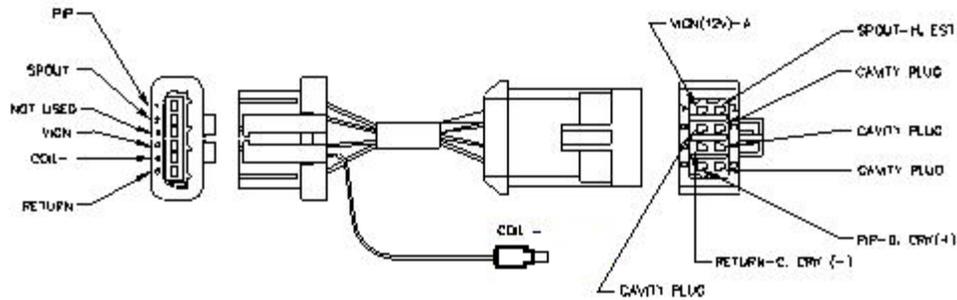
F-Body Small Cap HEI Ignition Adapter



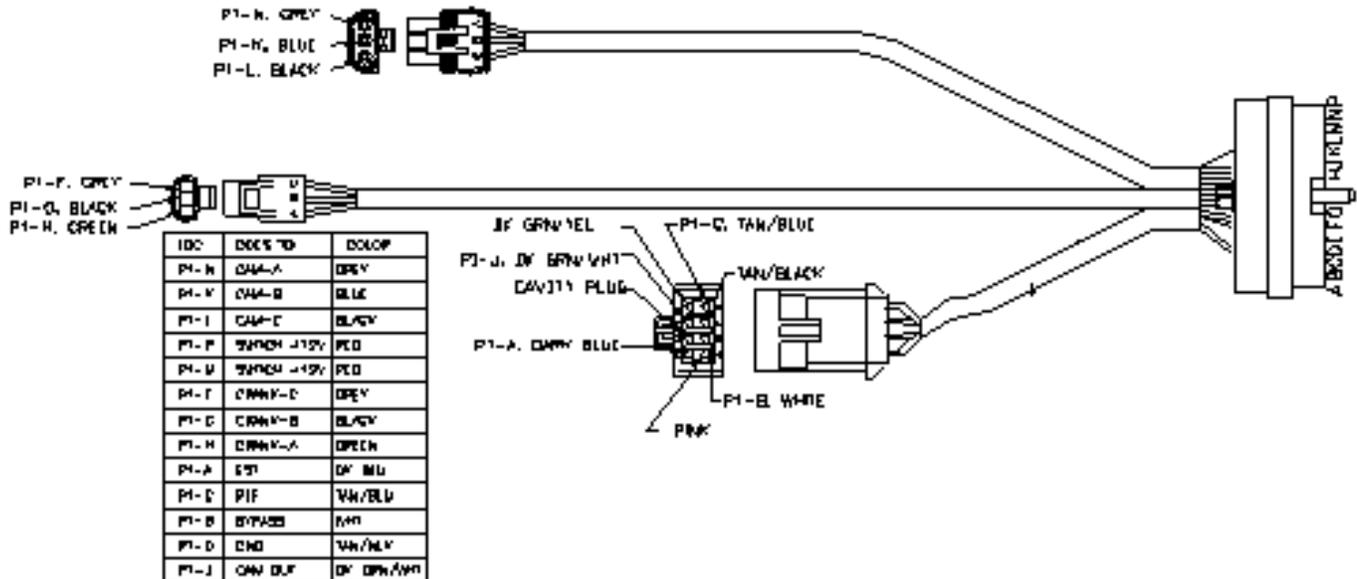
HEI Large Cap Ignition Adapter



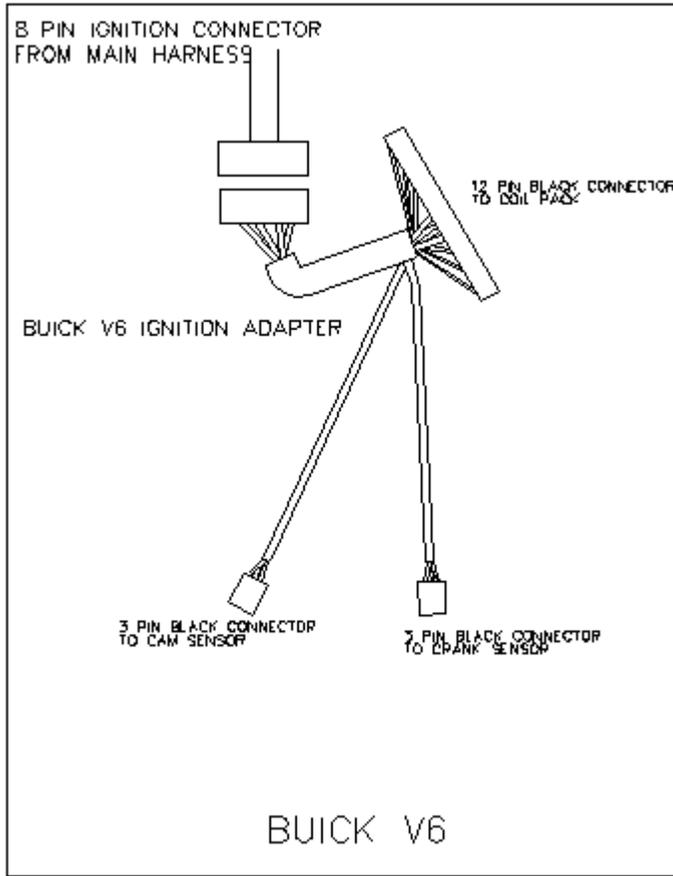
Ford Thick Film Ignition (TFI) Adapter



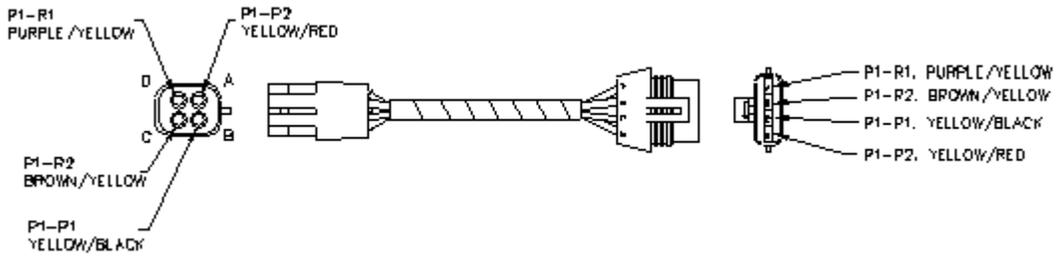
Buick GN DIS Ignition Harness



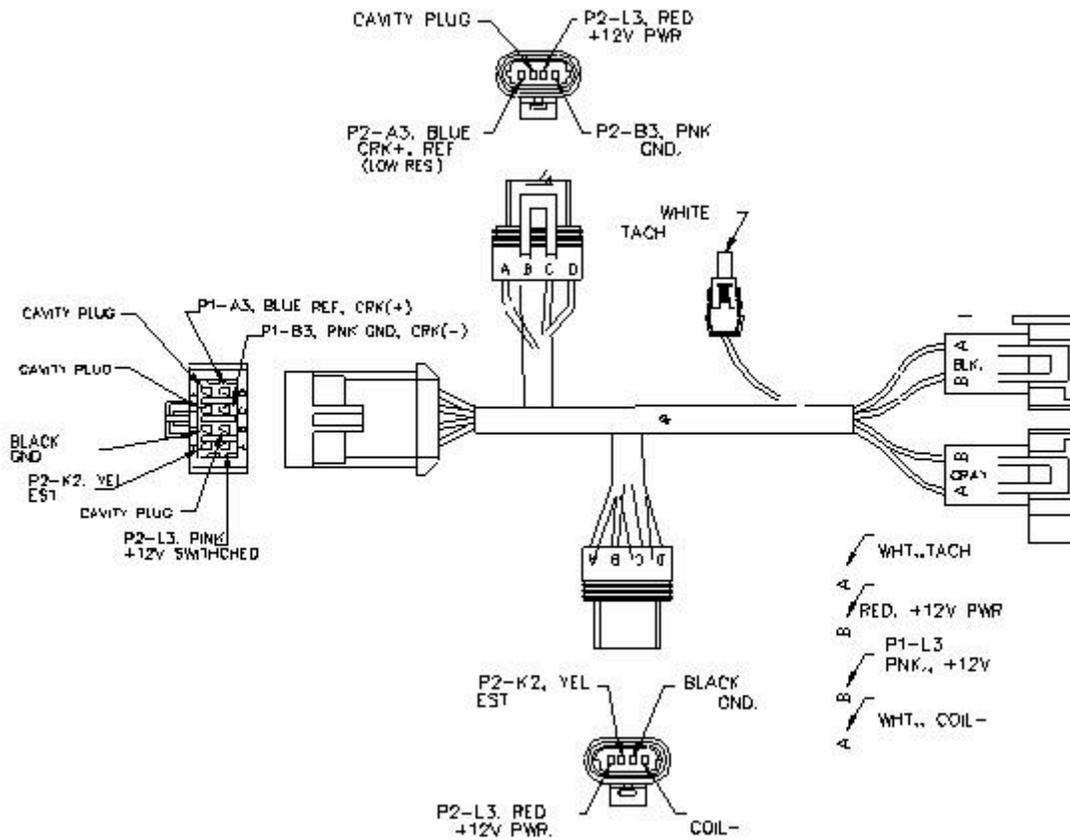
Buick GN DIS Coil Adapter



LT1 Idle Air Controller Adapter



LT1 Ignition Adapter Harness



LT1 TPS Adapter Harness

