Programmable Management System

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USER'S GUIDE

FOR

MITSUBISHI ECLIPSE/ EAGLE TALON

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Welcome to the Programmable Management System!

The Programmable Management System (PMS) from EFI Systems is a state-of-the-art engine control computer. The PMS reads the stock fuel injection and spark timing signals from the engine's ECU and changes them by an amount you specify, allowing different fuel and timing adjustments to be made for Idle, Part Throttle, and Wide Open Throttle (WOT) conditions.

In addition, the PMS includes specialized functions for maximizing the performance of turbocharged, supercharged, and nitrous-oxide injected vehicles, including turbo boost control on vehicles equipped for it. It's massive non-volatile storage capacity allows you to save three complete performance programs which can be instantly activated - even while driving!

Two Systems in One

The PMS is really two systems in one - it monitors your stock engine control computer's fuel and timing commands and sensor signals in real time, letting you know exactly what your engine is doing. More importantly, it allows you to reprogram the fuel and timing curves of your engine for maximum performance. Fuel adjustments are made in two percent (2%) steps, and timing adjustments in one degree (1°) increments.

A Complete Tuning System

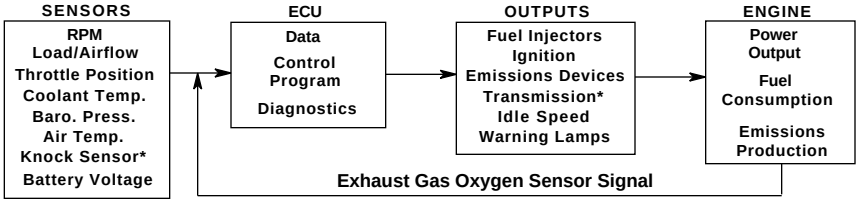
The PMS makes aftermarket performance "chips" obsolete. All aftermarket chips are a compromise between performance and coverage - the chip maker can't afford to burn a custom program for each vehicle. Even if this were possible, a chip is a static device - it can't react to changing conditions or vehicle modifications. The PMS can! It is a complete tuning system; one that allows you to maximize the performance of your vehicle both now and in the future. And, with the optional InterAQ PC software, you can even capture and log performance data.

Electronic Fuel Injection Basics

In the past performance tuning could be performed with a few hand tools and a basic knowledge of carburetors and mechanical distributors. Those times are gone. With the advent of electronic fuel injection and ignition control, the principles of performance tuning remain the same, but the tools required have changed. The EFI System's Programmable Management System is one of the tools you need. With it and some basic knowledge you can still tune your engine for maximum performance. But before you start, let's take a look at the basics of electronic fuel injection systems. NOTE: The following description is generic; a general overview of how electronic fuel injection works. All items discussed here do not necessarily apply to your specific vehicle.

Electronic Control Unit (ECU)

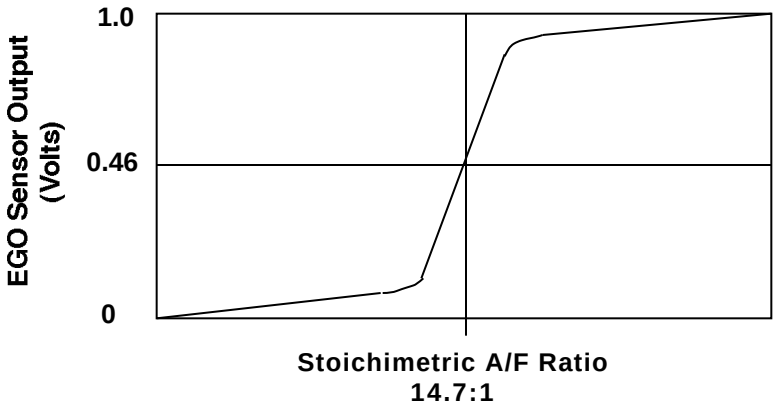
All electronic fuel injection (EFI) systems operate basically the same. Sensors measure engine operating conditions (RPM, load or air flow, throttle position, temperature, and exhaust gas oxygen content) and feed signals to the electronic control unit (ECU). The ECU is factory pre-programmed to analyze these inputs and produce appropriate command signals for the fuel injectors, ignition, idle speed, and emissions controls of your engine.. Thus the ECU determines the engine's power output, fuel consumption, and emissions production.



Since production variations cause fuel delivery to vary slightly from engine to engine, and it can change over time as components wear, most ECUs have the ability to learn to compensate. In essence, the ECU tries to achieve a perfect air/fuel ratio by making the mixture richer or leaner based on the signal from the exhaust gas oxygen (EGO) sensor. Once the chemically correct, or stoichimetric, air/fuel ratio has been achieved the ECU "remembers" how much fuel to add or subtract from the ECU baseline programming to achieve it. This value is used from then on to adjust the stock programming. Learned values are generally erased when the ECU is disconnected from the car's battery for any significant period of time.

Exhaust Gas Oxygen Sensor Signal

To minimize engine emissions a special sensor is used to measure the oxygen content of the exhaust gas; this value is "fed back" to the ECU and under specific conditions is used to produce a desired air/fuel ratio. This is known as closed-loop operation. Since closed-loop operation is important for drivability, fuel economy, and emissions control, the EGO signal is one of the most important signals to watch on the PMS monitor screens.



The typical EGO sensor produces a voltage which changes with air/fuel ratio. The signal is close to 0 volts for very lean mixtures, rises sharply near the "ideal" air/fuel ratio, and continues to rise to almost 1.0 volt for very rich mixtures. The PMS interprets signals from 0-0.46 volts as lean ("L") and signals above 0.46 volts as rich ("R") and displays "L" or "R" on the Main Monitor screen (see page 8). The Air/Fuel Monitor screen adds a two-digit voltage display to give some indication of how rich or how lean the mixture is. For example "87R" means the EGO sensor is reading 0.87 volts, indicating a rich condition.

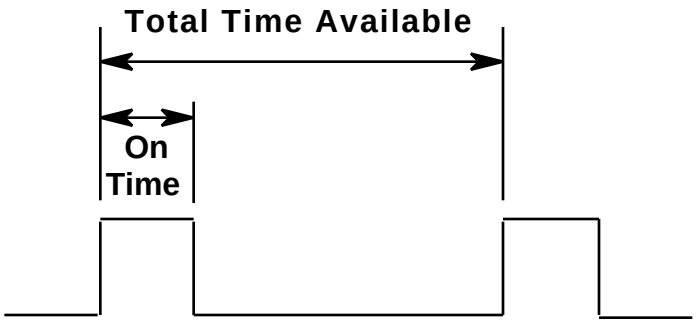
The EGO signal is a valuable tool for tuning your engine but it has some important limitations. First, EGO sensors operate correctly **only** when they are hot, about 600°F or above. Thus when an engine is first started the EGO sensor(s) will show lean ("L') until reaching operating temperature. Under most conditions this takes a minute or two; perhaps longer in very cold weather. If for some reason the EGO sensors must be moved to a different (non-stock) position in the exhaust system, keep them as close to the engine as possible. This will help maintain them at operating temperature.

The graph also illustrates another problem with EGO sensors; note that the sensor output is not a straight line. Once the air/fuel ratio gets outside of a narrow band around the stoichimetric, or perfect, value, sensor voltage barely changes at all for very rich or very lean mixtures. This is one reason why the ECU does not try to achieve a single, perfect voltage during closed loop operation. Instead, it varies the fuel commands to switch the EGO voltage back and forth around the desired value.

Finally, EGO sensor output must be interpreted in light of sensor quality and service life. Although laboratory-grade sensors can be manufactured and individually calibrated to read out air/fuel ratio directly, the realities of the assembly line and economies of production make them impractical and too expensive (at present) for everyday use. Thus mass-produced EGO sensors **should not be used to assign a precise air/fuel ratio other than that at the switch point (stoichimetric mixture)**. Also, the response of EGO sensors degrades with time and mileage. Sensors often require replacement after 50,000 miles, and shock (impact), overheating, or lead fouling (such as from using racing fuel) may also damage EGO sensors and render them inoperative.

Fuel Injectors

In older vehicles the sensing, control, and fuel metering functions were all performed by the carburetor. In EFI-equipped engines fuel delivery is done with injectors, which are small on/off valves controlled by an electric signal. When voltage is applied, they open and allow fuel to flow from a pressurized source (usually a fuel rail) into the manifold. When the voltage removed, they close, stopping the fuel flow. Since the injector is either fully open (“On”) or completely shut (“Off”), changing the rate of fuel flow can only be accomplished by changing the pulse width, or “on-time” of the injector, or by changing the fuel supply pressure.



As the accompanying graph shows, injector pulse width cannot be increased indefinitely. For every rpm there is a fixed maximum time for each injection pulse. Injector “On” time cannot exceed this value or the end of one pulse will overlap the start of the next, at which point the injectors are on all of the time. This is condition is known as “static” or “DC.” Thus one way to measure the rate of fuel delivery is to measure the pulse width in milliseconds (1 millisecond = 1/1000 sec). Another method is to divide the pulse width by the total available pulse width. This fraction is known as the duty cycle of the injector and is usually expressed as a percentage. Both of these measurements of injector performance appear on the PMS Air/Fuel Monitor. Generally speaking, injectors operate best

with a duty cycle between 5% and 85%. When injectors are on for very short periods (such as is the case at idle), their fuel delivery can become erratic. The same is true for duty cycles above 85%-90%. Duty cycle values above 90% indicates that larger injectors may be required. One of the most vital uses of the Monitor Modes of the PMS is to confirm that your injectors are operating within their limits.

Note that total fuel delivery depends not only on the injectors, but also on the ability of the fuel pump to provide adequate flow at the desired pressure. The stock pump is sized to deliver the fuel needed to sustain your engine's fuel requirements at it's stock horsepower, with some some additional margin. Where the power output has been increased a larger pump may be needed.

The PMS as a Tuning Tool

The PMS allows you to customize your engine's tuning for your vehicle and driving style. You do this by altering the fuel and timing values to improve drivability, throttle response, and wide-open throttle (WOT) power. Here are some tips to help you get the most from your PMS and your vehicle.

Stock Calibration - Safe But Slow

In trying to find the optimum set of adjustments for your vehicle, it is helpful to know the short-comings of the stock fuel and timing calibration to give you some direction for your initial adjustments. Stock fuel and timing values are generally very conservative (safe). This means fewer warranty claims for the manufacturer but in some cases they limit vehicle performance. Spark advance is almost always less than optimum for several reasons.

First, manufacturers have to allow for a wide range of fuel quality, from high-octane racing gas to the cheapest unleaded regular. Second, not all engines are equipped with a knock sen-sor(s) to adjust the factory calibration for the effects of engine wear, chamber deposits, and the occasional batch of bad fuel etc.

Every engine has a unique spark advance curve, or "Wmap," which produces peak torque at a given RPM. This is sometimes referred to as Maximum Brake Torque (MBT) timing. MBT spark timing for any given load and RPM generally occurs very near the onset of spark knock or "ping." The problem lies in that this magic point (called incipient knock) begins to change the moment the car leaves the showroom. To begin with the owner can choose from a wide variety of fuels which can dramatically affect the engine's spark knock behavior. Then as the engine accumulates mileage mechanical wear and the formation of deposits can also change the optimum timing curve. Faced with this situation engineers choose a conservative spark advance map.

These same uncertainties also make it impossible for EFI Systems to provide an optimum spark timing map for the PMS. You will need to determine this map yourself. The best method to determine part throttle timing is to work on one Load/RPM point at a time, increas-ing the timing in 1 or 2 degree steps until knock is detected, then backing off 2 degrees or so. For WOT, be even more careful, increasing the advance in 1 degree steps. The PMS Monitor Mode shows the total spark advance and is an invaluable tool in finding MBT timing.

Fuel Delivery

Many owners of fuel-injected vehicles think the way to increase power is to raise their fuel pressure or install larger injectors. This is misleading since **MORE** fuel is not necessarily the goal - getting the **RIGHT** amount of fuel for the air pumped by the engine is the key. This is why the PMS allows you to both add and subtract fuel.

Fuel mixture control is separated into two modes: closed-loop and open-loop. During closed-loop engine operation (Idle and Low and Medium Load, 2200 RPM and below) the ECU uses the oxygen sensor(s) to trim the fuel/air ratio to the chemically perfect value of 14.7:1 for best emissions performance. Thus, any fuel adjustments you make in these areas should be canceled out by the ECU. For Mass Airflow equipped vehicles, a slight increase in fuel in these areas **may** help throttle response because of the way tip-in enrichment is applied. For Speed Density equipped vehicles the same advice applies for stock engines. For modified Speed Density engines, fuel often needs to be subtracted at these points because of decreased of pumping efficiency. For example cams with more duration and overlap than stock sacrifice low-RPM torque for mid and upper RPM power.

Open-loop fuel adjustments are not canceled out by the ECU. Open-loop operation is generally considered to be at Medium and High Load, 4000 RPM and above and of course, wide-open throttle (WOT). Since emissions at these loads and speeds are essentially unregulated, engineers generally choose a very rich fuel curve to protect the engine from knock and thermal stress and to insure that fuel pump and injector wear will not result in dangerously lean conditions over the life of the vehicle. In doing so they compromise peak power and harm fuel efficiency. Stock vehicles generally respond to fuel subtraction in these open-loop areas. For modified engines, the guidelines above apply once again. Mass Airflow vehicles may still respond to fuel subtraction while Speed Density vehicles may need substantial fuel addition if the modifications have increased mid and upper RPM power. The Monitor Mode displays the reading of the oxygen sensor(s), Rich or Lean. Once the engine has reached normal operating temperature this should display “R” during heavy acceleration. If the Fuel Injector Duty Cycle (F.XX% on the Air/Fuel Monitor Mode Screen) exceeds 95% the engine probably needs larger injectors or more fuel pressure.

These guidelines should help you find the right combination of fuel and timing adjustments far your vehicle. We recommend you keep one of the three Data Sets as a pass-through, or stock, program (no adjustments) for comparison's sake. One of the other two Data Sets might be used for a mild performance gain and the third for a no-holds-barred, maximum performance program for use with premium fuel (93+ octane). Make the mild performance (stock) Data Set the default, and switch to the other Data Sets when you need them.

The PMS and your Mitsubishi Eclipse

The PMS Control Knob -

The PMS gives you, at the turn of a knob, three separate performance programs. Each position of the PMS control knob takes you to one of three pre-programmed data sets.

- Position 1 selects the stock data set and retains the stock performance of your vehicle. The maximum boost pressure with the knob in this position is 15 psi.
- Position 2 selects an increased performance data set for higher-performance driving. The maximum boost pressure with the knob in this position is 17 psi.
- Position 3 selects the maximum performance data set. In this position the maximum boost pressure available is 19 psi.

But that is only the beginning of the control available with the PMS. As you gain experience with the way your car responds to PMS inputs you can use the PMS Data Terminal to modify any or all of the three data sets to customize your vehicle's performance to your own needs, or make adjustments for additional engine modifications.

Restoring the Original Programming

Should you not like the results of your changes to the data sets, the as-shipped data settings can be restored by following the setup instructions noted in Appendix A, "Restoring the Original Data," page 37. This procedure should also be followed if at some point in the future you change from 435cc to 550cc injectors.

IMPORTANT:

Before using the PMS in knob positions 2 or 3, or before changing any of the stock fuel or timing calibrations on your Mitsubishi, **verify that initial ignition timing is set to factory specifications.**

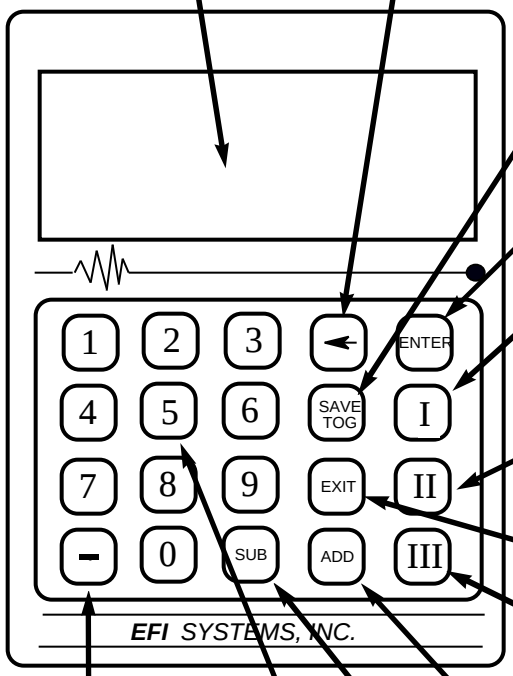
! **Should spark knock become apparent, timing must be retarded until NO spark knock remains, or serious engine damage may result.** Initial timing is mechanically determined by the position of the vehicle's distributor/spark trigger unit relative to the crankshaft; it is not controlled by the engine's ECU or the PMS. !

Full instructions for the advanced uses of the PMS are explained in the following pages.

Have fun!

The PMS Data Terminal

Layout and Key Functions



Display Screen

Arrow Key - Backspace or delete. Used to correct erroneous entries, etc.

SAV/TOG Key - In the Monitor mode, toggles between Data Sets. In the Edit mode, toggles between Run and Saved data, or Saves data

Enter Key - Used to enter keyed values. (like the "Enter" key on a computer)

Quick Key I - In the Monitor mode, used to select the Main Monitor screen. In the Edit mode, used to switch between Fuel and Timing Table cells, by Load

Quick Key II - In the Monitor Mode, used to select the Air/Fuel Monitor screen. In the Edit mode, used to switch between Fuel and Timing Table cells, by RPM

EXIT Key - Use to abort the Edit mode and return to the Monitor Mode.

Quick Key III - In the Monitor Mode, used to select the Accessory Monitor screen. In the Edit mode, used to switch back and forth between Fuel and Timing Tables

Add Key - Used for adding values. Each keystroke adds 2% in the Fuel Table, 1° in the Timing Table

Sub Key - Used for subtracting values. Each keystroke subtracts 2% in the Fuel Table, 1° in the Timing Table

Minus Key - Used for entering negative numeric values.

Numeric Keypad - Used for direct entry of numeric values.

Monitoring Your Engine

One of the most unique features of the PMS is its ability to monitor critical engine control parameters. In the Monitor mode the PMS Data Terminal reports engine data in "real time," like a sophisticated set of electronic gauges, so you know exactly how your engine is operating. You can actually see how performance modifications affect engine operation.

When you start your engine, or just turn the key ”On,” the PMS automatically enters the Main Monitor Mode. Since the PMS can display so many pieces of data, there are three separate Monitor screens, each displaying a different set of measurements.

Main Monitor Mode

To activate, press Quick Key 

RPM: 850 **L: Idle ✻**

02 : R **T:28° 1r**

RPM: Actual engine speed as measured using the distributor trigger signal. Accurate to +/-10 rpm.

L: Load Value - indicates the load (power) level at which the engine is operating and which table is active: Idle, Part Throttle or Wide Open throttle (WOT).

✻ Trouble Indicator - warns that the PMS's internal diagnostics have detected an error. Switch to the Accessory Monitor Mode to view the associated Error Code.

O_2: Fuel/Air Mixture as indicated by the Heated Exhaust Gas Oxygen (HEGO) sensor. R=Rich and L= Lean

T: Total spark advance in degrees BTDC. This value includes the stock advance plus any programmed adjustment.

“1” Active Data Set Number. This number (1, 2, or 3) shows which of the three Data Sets is in use.

“r” Edit Mode Indicator. During editing (programming) this value shows whether the Saved (“s”) or Run (“r”) versions of the Data Set being edited is currently active. When not editing, or running on a saved Data Set, no letter is displayed.

Air/Fuel Monitor Mode

To activate, press Quick Key 

RPM: 850 **PW: 12.3**

02 : 65 **F : 84%**

RPM: Actual engine speed as measured using the distributor trigger signal. Accurate to +/-10 rpm.

PW: Fuel Injector Pulse Width. This is time (in milliseconds) that the injectors are “On” for each pulse of fuel.

O_2: Oxygen sensor voltage. These values indicate not only whether the HEGO sensor is reading a rich or lean condition, but also how rich or how lean. Zero (0V) indicates very lean and 99 (1.0V) indicates very rich.

Caution: Stock O_2 sensors are not laboratory grade instruments, so a precise fuel/air ratio cannot be derived from this value.

F: Fuel Injector Duty Cycle. This value (0-99%, MAX) indicates the total fuel delivery to the engine as a percentage of the maximum fuel the injectors can deliver. Injectors should not be operated above 85 - 90% for extended periods.

Accessory Mode

To activate, press Quick Key 

MP : 10.3 **N2O : Off**

Acc. **E : 0000**

MP: Manifold Pressure. Indicates manifold vacuum or boost pressure. (0-30 in Hg vac, 0- 31 psig boost).

N_2O: Nitrous Oxide Input. Indicates the state (ON or OFF) of the optional N_2O input. When N_2O is on and + 12V is applied to this input, the N_2O Fuel and Timing tables are activated.

Acc: Internal Diagnostics; Not Used

E: Error Code - A4-digit value which indicates what error conditions have been detected by the PMS’s internal diagnostics. (See Appendix C, Self-Diagnostics, page 39, for a list of possible error codes.)

Using the PMS Data Terminal -

Editing, Switching, and Saving Data Sets - An Overview

The PMS control knob allows you to instantaneously switch between Data Sets, but the tool for accessing the advanced features of the PMS is the Data Terminal. This section describes the basics of using the Data Terminal. It is followed by a tutorial to give you "hands on" experience with using it.

The PMS allows you to make and save your own modifications to your car's fuel and timing tables. These changes may be stored in any of the three Data Sets. A Data Set consists of seven tables, each containing fuel and timing data which can be edited (modified) at will. Different calibrations can be stored in each Data Set, allowing three complete "Performance Programs" to be on hand at any time. Any Data Set may be reedited, or completely discarded and replaced, at any time should editing not produce the desired results.

Switching between Data Sets to verify the effect of any changes you have made, or to tailor your vehicle's performance to a specific situation, is easy to do. While driving, the control knob is used to select the active data set. However, for editing the PMS Data Terminal is used to select the Data Set to be edited, edit the data, switch back and forth between the edited and original data to compare performance, and to save the changes.

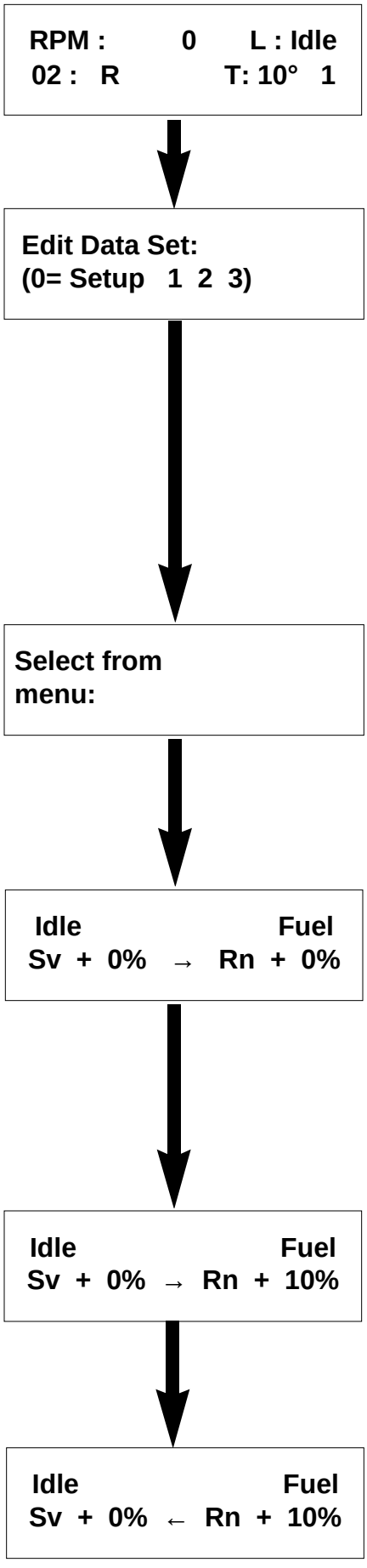
NOTE: Once the the Data Terminal has taken control of the PMS (by entering the Edit mode) the control knob becomes ineffective until the ignition is turned off and then back on again.

Before starting, a note about the format of the instructions to follow. The text in the center column describes the operation being performed. The PMS display is shown on the left side of the page, with the right are the keystrokes required **to take you to the next screen** shown in the left hand column**.** By following the key stroke sequence you can practice using your own PMS.

Editing a Data Set -

Connect the data terminal to the data transfer cable. Then start the engine or turn the ignition key "On." The PMS will enter the Main Monitoring mode, with the Data Set number currently selected by the control knob appearing in the lower right corner of the display.

Turn to the next page, and let's begin.



Editing starts by pressing "ENTER." This will bring up the screen "Edit Data Set:"

Select a Data Set to edit by pressing 1, 2, or 3 followed by "ENTER." The selected Data Set is copied into RAM and becomes active, "Select from menu:" appears, and editing may begin. Select Data Set 1 to edit by pressing "1," followed by "ENTER."

The use of "0 = Setup" is covered separately. (See Two-Step Rev Limiter, page 33, Appendix A, page 37, and Appendix B, page 38)

To exit the Edit mode and return to the Monitor mode at any time, press "EXIT." (Don't do this as this time.)

After a Data Set is selected, "Select from menu" appears. Each editable item has a 3-digit code. Enter the code number of the menu item you wish to edit, in this case "100 - Idle," by pressing keys "1-0-0", followed by "ENTER." (Alist of editable menu items is found on page 15)

The Idle Fuel screen is now displayed.

Edit the Idle Fuel Table by adding 10%. There are two ways to do this. You can either press the "ADD" key five times (remember, fuel moves in 2% increments) **OR** you can enter "10," followed by "ENTER." In either case the new data automatically becomes the Run (Rn) setting, indicated by the "→" pointing towards "Rn."

If the engine is running you can compare the performance of the edited data set with the original, unedited version by pressing the "SAV/TOG" key. This will switch back to running on the original, or Saved (Sv) version of the Idle Fuel Table, indicated by the "→" now pointing to Saved (Sv).

This allows you make back-to-back comparison tests of your changes as you drive, to determine the effectiveness of any changes.

To Exit the Monitor Mode and select a Data Set to Edit, Press: [ENTER]

To select a Data Set to Edit, press:

[1], [2], or [3]

followed by: [ENTER]

To abort the Edit mode and return to the Monitor mode, press: [EXIT]

To select a Table for editing press:

[1] [0] [0]

followed by: [ENTER]

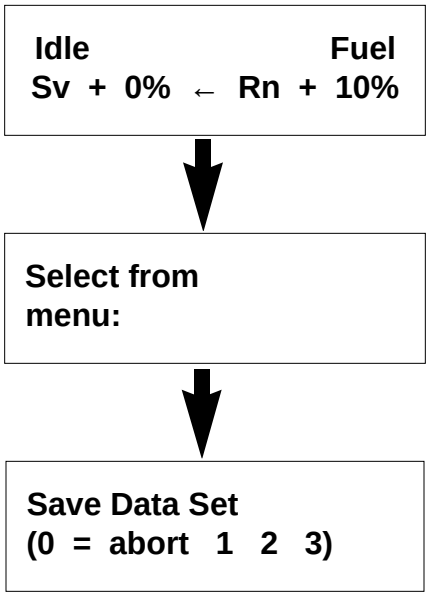
Press [ADD] five times

OR

[1] [0] then [ENTER]

To switch between the edited ("Rn") and original ("Sv") tables to compare the results of changes, press: [SAV TOG]

Saving the Changes -



When you are finished editing and are ready to SAVE (or discard} your changes, press “ENTER.” This will bring up “Select from menu:”

To begin Saving your changes, press: ENTER

Pressing “SAV/TOG” will display the screen “Save Data Set:”

Then press: SAV TOG

At this point the edited data may be saved into any of the three available Data Sets or it may be discarded. To save an edited Data Set, press “1”, "2” , or “3” as desired, followed by “ENTER.” In this example, save to Data Set 2 by pressing “2” followed by “ENTER”. To discard any changes and exit the Edit Mode, press “0”, followed by “ENTER”.

After changes are saved the PMS returns to the Monitor Mode and the Data Set into which you saved your changes becomes active.

1, 2, or 3

followed by: ENTER

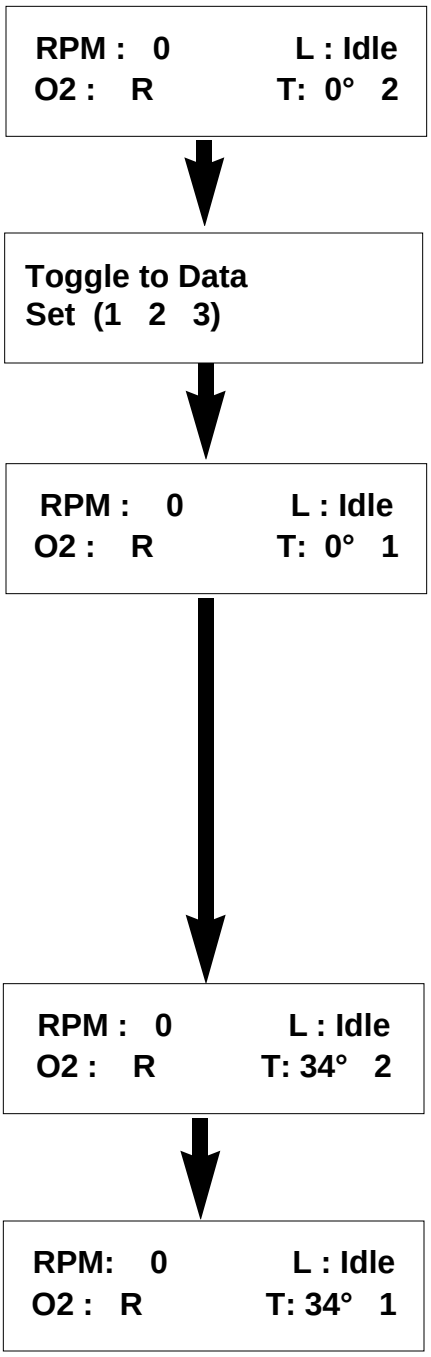
Until you have switched the ignition “Off” and back “On” again, only the data terminal has control over which data set is active. The control knob has no effect, regardless of it’s position.

At this point if you turned the ignition off and the changes would be retained, as they are stored in permanent memory.

Briefly, those are the basic operations used to program the PMS. In the next section “Getting Started,” and the tutorial that follow it, we will talk you through the programming operations step-by-step so that you can really get to know the capabilities of the PMS and how to use them.

Switching to a Different Data Set

When not in the Edit mode, the SAVE/TOG key has a different function; it allows you to change to a new active Data Set. Switching to a new active Data Set can only be done outside of the Edit Mode. You may make this switch with the key on and engine off, or while driving. **NOTE:** This does not change the default Data Set (the one which is active when you first turn your key on); it is always #1. The Default Data Set may be changed, if you wish, by editing Data Set 0=Setup.



To change to a new Data Set, press the "SAV/TOG" key. This will bring up the screen "Toggle to Data Set (1 2 3)."

Press: SAV TOG

Press the key for the Data Set you wish to switch to (1, 2, 0r 3), followed by "ENTER."

1, 2, or 3

followed by: ENTER

For this example we switched from Data Set 2 to Data Set 1, which is now active and running the engine. Switching to a new Data Set changes not only all the fuel and spark adjustments, but also any Option selections, such as Boost and Nitrous Oxide. (These will be discussed in detail later.)

Now, if you wish to make back-to-back comparisons between Data Sets 1 and 2, you can do so by pressing "SAV/TOG."

Press: SAV TOG

Pressing it again will take you back to Data Set 1, etc.

Press: SAV TOG

Briefly, those are the basic operations used to program the PMS. In the next section "Getting Started," and the tutorial that follow it, we will talk you through the programming operations step-by-step so that you can really get to know the capabilities of the PMS and how to use them.

Getting Started -

To familiarize you with operating the PMS this manual will take you step-by-step through a practice exercise where you will make a set of basic adjustments for Idle Fuel and Part Throttle Fuel and Ignition timing. (Timing adjustments are not effective below 1600 RPM on the Mitsubishi, so the Idle TIming Table will not be altered.)

Before starting, take some time to become familiar with the tables and data that you will be working with. (For your information the Wide Open Throttle - WOT - Tables are also shown, even though you won't be editing them in this exercise.)

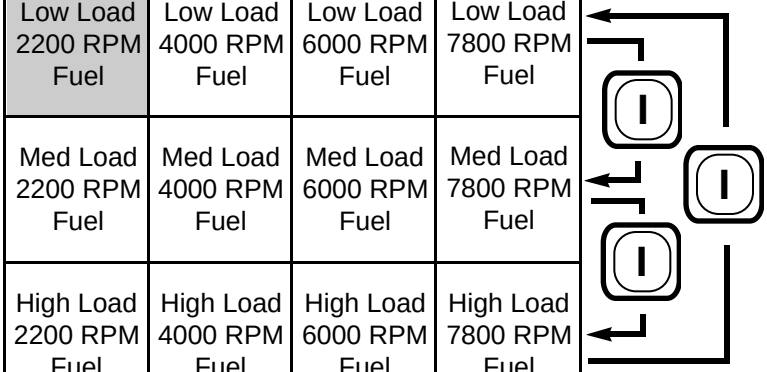
Idle Fuel (Menu Item 100)
Idle Fuel

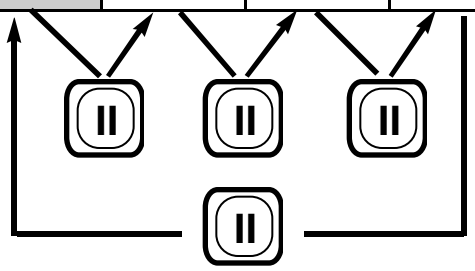
Part Throttle Fuel (Menu Item 200)			
Low Load 2200 RPM Fuel	Low Load 4000 RPM Fuel	Low Load 6000 RPM Fuel	Low Load 7800 RPM Fuel
Med Load 2200 RPM Fuel	Med Load 4000 RPM Fuel	Med Load 6000 RPM Fuel	Med Load 7800 RPM Fuel
High Load 2200 RPM Fuel	High Load 4000 RPM Fuel	High Load 6000 RPM Fuel	High Load 7800 RPM Fuel

Part Throttle Timing			
Low Load 2200 RPM Timing	Low Load 4000 RPM Timing	Low Load 6000 RPM Timing	Low Load 7800 RPM Timing
Med Load 2200 RPM Timing	Med Load 4000 RPM Timing	Med Load 6000 RPM Timing	Med Load 7800 RPM Timing
High Load 2200 RPM Timing	High Load 4000 RPM Timing	High Load 6000 RPM Timing	High Load 7800 RPM Timing

WOT Fuel (Menu Item 300)			
Full Load 2200 RPM Fuel	Full Load 4000 RPM Fuel	Full Load 6000 RPM Fuel	Full Load 7800 RPM Fuel

WOT Timing			
Full Load 2200 RPM Timing	Full Load 4000 RPM Timing	Full Load 6000 RPM Timing	High Load 7800 RPM Timing





Note that the Part Throttle and WOT tables are made up of a number of "cells," each cell containing the settings related to a particular condition of engine load and RPM. The Part Throttle Fuel and Timing tables have nine cells each, and the WOT tables have three. Within each table cell is a value that you can change, or edit, with the PMS.

The shaded boxes in the tables are the starting points for editing each Menu Item. For example, Menu Item 200 (Part Throttle Fuel) modifications begin at the cell for Fuel at Low Load and 2200 RPM. When this cell has been edited, Quick Key I is used to move to the next cell, “Med Load, 2200 RPM,” in the Fuel table. Or, if you wish, Quick Key III can be used to move to the “Low Load, 2200 RPM,” cell in the Part Throttle Timing tables.

Assume that you have edited the Low Load, 2200 rpm cell of the Fuel table. Pressing Quick Key I moves you to the “Medium Load, 2200 RPM" cell, and pressing it again moves you to the "High Load, 2200 RPM” cell. Pressing it a third time cycles you back to the "Low Load" cell, all at the same RPM. Quick Key II operates similar to Quick Key I, but cycles through the cells according to RPM. Pressing Quick Key III at any time moves you to the corresponding load/RPM cell in the other table, i.e. from Fuel to Timing, or Timing to Fuel.

Programming the PMS - A Tutorial

The Fuel and Timing Table changes you will make in this section are intended only to familiarize you with programming the PMS; they will not benefit your car’s performance. When you have finished the tutorial discard the changes; doing that is part of the exercises.

Tuning for optimum performance is engine-specific. Modified engines will require substantially different programming than stock ones, and programming for modified engines will vary widely depending on the type and extent of the modifications. Once you become comfortable with the PMS, you'll be able to make specific adjustments of your own to optimize the performance of your particular vehicle.

As stated earlier it is **very** important verify that initial ignition timing is set to factory specifications, before changing any stock fuel or timing calibrations. **Should spark knock become apparent at any time, timing must be retarded until NO spark knock remains, or serious engine damage may result.** Initial timing is mechanically determined by the position of the vehicle’s distributor/spark trigger relative to the crankshaft; it is not controlled by the engine’s ECU or the PMS.

If at any time you wish to abort any editing sequence, or you want to go back and "take it from the top,” simply turn the ignition key “Off,” wait about 15 seconds, and turn it back on again. At that point you will be back at the beginning of the programming sequence (none of the adjustments you just made will have been saved) so the original calibrations will be unchanged. You can also abort an editing sequence by saving it to Data Set 0.

Editing can be done with the engine running, or with the ignition key "On" and the engine not running. Because the changes you will make in this tutorial are for educational purposes only and not useful for your Mitsubishi, it would be better to do this tutorial with the engine not running.

Making Fuel and Timing Adjustments

The sample Fuel and Timing Tables below show the changes you will make while familiarizing yourself with the PMS. As this is only a tutorial to familiarize you with the PMS, you won't be altering the 6000 and 7800 RPM cells or the WOT Tables; the procedures for switching to and editing them are the same as for the tables and cells you will be practicing.

Idle Fuel (Menu Item 100)
Idle Fuel

Part Throttle Fuel Adjustments:				
RPM	2200	4000	6000	7800
Low Load	None	None	None	None
Med Load	-4%	-6%	-8%	None
High Load	-6%	-8%	None	None

Part Throttle Timing Adjustments:				
RPM	2200	4000	6000	7800
Low Load	None	None	None	None
Med Load	+4°	+5°	+6°	None
High Load	+4°	+5°	None	None

WOT Fuel Adjustments:				
RPM	2200	4000	6000	7800
Full Load	None	None	None	None

WOT Timing Adjustments:				
RPM	2200	4000	6000	7800
Full Load	None	None	None	None

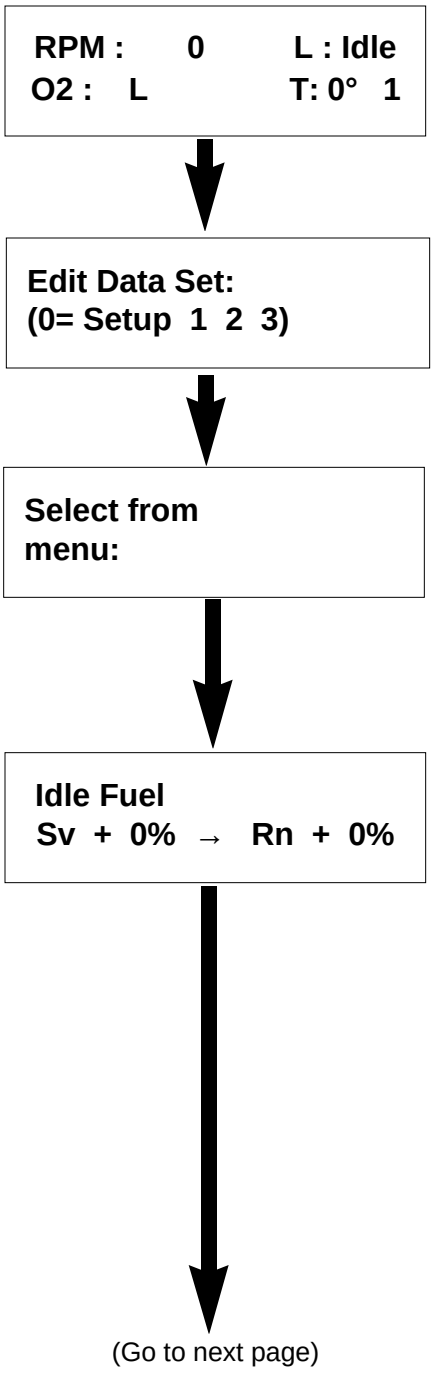
To access specific menu items in the Edit mode, enter the appropriate 3-digit code for the item you wish to edit from the table below. For quick reference the Menu Item numbers are on the back of the PMS Data Terminal.

100 Idle
200 Part Throttle (PT)
300 Wide Open Throttle (WOT)
400 Not used
500 N2O
600 Boost
700 Not used
800 Temperature compensation
900 Performance Options

Idle Table Adjustments

Start by editing Data Set 1 to lean the idle fuel mixture by 4%. To do so turn the ignition key "On" and follow the key strokes shown.

Note: In this practice exercise the engine is not running, but in the future you may be using the PMS when it is. **When working with the PMS or doing anything else that requires running the engine, ALWAYS have the vehicle either outdoors or in a well-ventilated area; preferably outdoors. Prolonged breathing of exhaust fumes can result in unconsciousness or death.**



The Monitor Mode is automatically selected when the ignition key is switched "ON". The control knob is in position No. 1 and Data Set 1 is active as indicated by the number 1 at the lower right of the display screen.

Any of the three Data Sets may be selected for editing, but for practice we are going to edit Data Set 1.

This will bring up "Select from menu:" Enter the appropriate three-digit code for the table to be edited. In this case select the Idle table by entering "100". (Press "1"-"0"-"0" followed by "Enter")

The Idle Fuel screen is now displayed. Because no previous editing has been done, both the Saved (Sv) and Run (Rn) values are zero. Begin the Fuel adjustment by pressing the "SUB" key twice; remember that in the Fuel Tables, a 2% adjustment is made each time the key is pressed. Watch the "Rn" value change as you press the key.

Notice that the Run value ("Rn") changes to -4% while the Saved value ("Sv") is unchanged. Note also that the arrow ("→") is pointing towards the run value, indicating that it is the one being used by the engine. Later you will learn to switch or "Toggle" between the Sv and Rn values to instantly compare the effect of the changes.

To Exit the Monitor Mode and select a Data Set to edit, Press: ENTER

Select Data Set 1, press

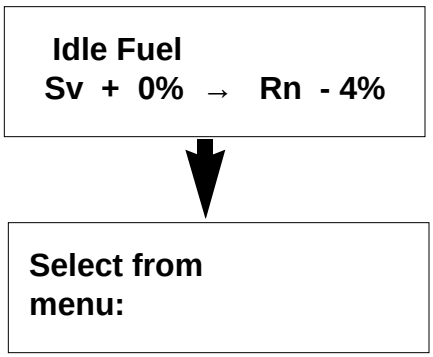
1 followed by ENTER

Select the Idle Table for editing by pressing:

1 0 0

followed by: ENTER

SUB Press two times



Press “ENTER" to terminate editing the Idle table and bring up the “Select From Menu:" screen.

Press: 

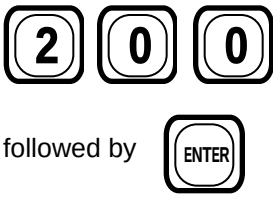
Part Throttle Adjustments

Editing the Idle Fuel Table introduced you to the basics of using the PMS; now you are ready to make Part Throttle Fuel and Timing adjustments. There are twelve Load/RPM points in each of the Part Throttle tables, but in this tutorial you will edit only four of them; the Medium Load and High Load cells at 2200 and 4000 RPM. Identical procedures are used to edit the 6000 and 7800 RPM cells and the WOT tables.

Select from menu:

Begin at the "Select from menu:" screen where you left off under Idle Adjustments. Select the Part Throttle Fuel Table by entering the appropriate three-digit code—in this case 200 ("2"-"0"-"0"), followed by "ENTER."

Select the Idle Table for editing by pressing:



Prt LL 2200RPM F
Sv + 0% → Rn 0%

Part Throttle Fuel Table adjustments begin at the Low Load and 2200 RPM cell. However, you aren't making any adjustments to the Low Load settings, so press Quick Key I to move to the Medium Load, 2200 RPM cell.

Press Quick Key I 

Prt ML 2200RPM F
Sv + 0% → Rn 0%

Adjust the fuel 4% leaner by pressing the "SUB" key twice, or use the alternate method of pressing "-" and "4", followed by "ENTER". Either method produces the same result.

Press two times
OR
press:

Prt ML 2200RPM F
Sv + 0% → Rn - 4%

If the engine is running, the new value is used by it as soon as it is entered. Now move to the corresponding Load/RPM point in the Part Throttle Timing Table by pressing Quick Key III.

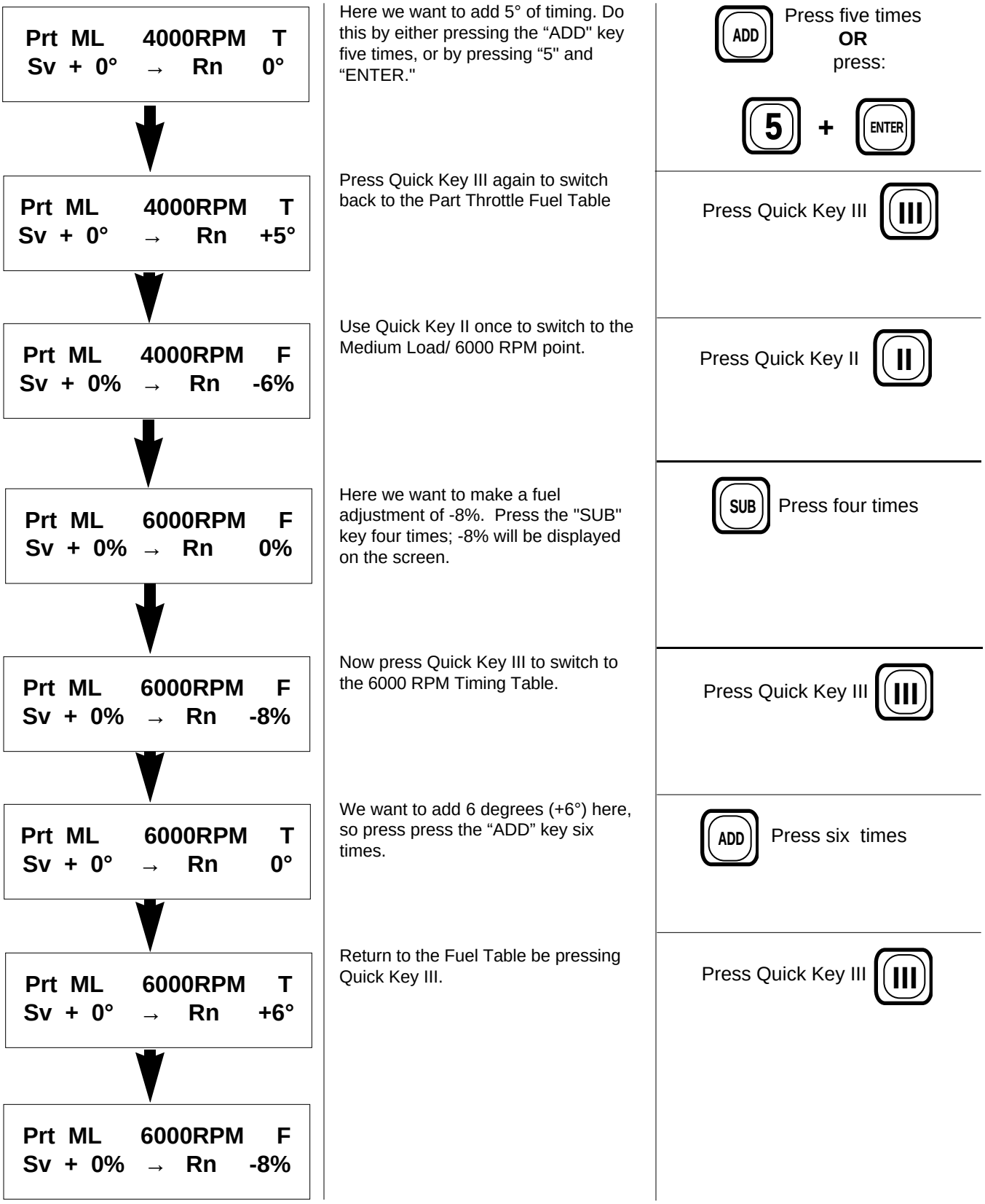
Press Quick Key III 

Quick Key III switches back and forth between the Fuel and Timing tables within a particular set of tables (Part Throttle, WOT, etc.) but does not alter any information in them. When switching tables Quick Key III takes you from the cell you were in to the corresponding cell in the other table. That is, if you are in the Part Throttle, Medium Load, 6000RPM cell for Fuel, Quick Key III will move you to the Part Throttle, Medium Load, 6000 RPM cell for Timing, and vice-versa.

(Display on following page)

Prt ML 2200RPM T **Sv + 0° → Rn 0°**	With the Timing table displayed, add 4° of timing by pressing the “ADD" button four times or by pressing "4" and “ENTER." Note that since we have already modified the Fuel table the “→“ already points to the “Rn” value.	Press four times **OR** press: Press: 4 + ENTER
Prt ML 2200RPM T **Sv + 0° → Rn + 4°**	After the Fuel and Timing adjustments are completed, if the engine was running you could compare the results of the edited Data Set ("Rn") to the original Data Set ("Sv") by pressing the "SAVE/ TOG" Key. Note that the “→“ always points to the active value, i.e. the one the engine is using.	Press: SAV TOG
Prt ML 2200RPM T **Sv + 0° ← Rn + 4°**	When the arrow (“←“) points to the saved value ("Sv"), the PMS is using the original Data Set before any changes. In this case, the saved data is Data Set 1 without the Idle and Part Throttle modifications that you just made. Pressing the "SAVE/TOG" key again switches back to the changed (Rn) data.	
Prt ML 2200RPM T **Sv + 0° → Rn + 4°**	The adjustments for Medium Load/ 2200 RPM are now completed, but before moving to the next point, switch back to the Fuel table by pressing Quick Key III again.	Press Quick Key III III
Prt ML 2200RPM F **Sv + 0% → Rn - 4%**	Move from Medium Load/2200 RPM to Medium Load/4000 RPM by pressing Quick Key II.	Press Quick Key II II
Prt ML 4000RPM F **Sv + 0% → Rn 0%**	Once there make a fuel adjustment of -6% by pressing the “SUB" key three times (remember, fuel adjustments are in 2% increments).	SUB Press three times
Prt ML 4000RPM F **Sv + 0% → Rn -6%**	Press Quick Key III to switch to the Timing Table at this Load/RPM point.	Press Quick Key III III

(Display on following page)



This completes editing the Medium Load points at 2200, 4000, and 6000 RPM, and if we wished we are ready to make adjustments for Part Throttle, High Load, and move on to the Wide Open Throttle (WOT) Tables. However, we won’t be doing them at this time.

To access the Part Throttle, High Load Tables, you would press Quick Key I and edit as you did above. When finished with those you would press “ENTER,” bringing up the “Select from menu:” screen. Then enter Menu Item 300 for the Wide Open Throttle (WOT) table and proceed from there, moving between the tables and cells exactly as you did with the Idle and Part Throttle Tables.

Before leaving this section, press Quick Key II once to return to Medium Load, 2200 RPM. Then use Quick Key II to cycle through the 4000, 6000, and 7800 RPM points, then back to the 2200 RPM point.

You can see that the Quick Keys I and II move you to the next highest load or RPM point, but if you're already at High Load or 7800 RPM, these keys "wrap around" to the lowest values (Low Load or 2200 RPM).

Please go on to the next page; do not turn off the ignition yet.

Testing and Saving Changes

If you were editing the Fuel and Timing Tables “for real,” you would want to compare the performance difference between the old and new data before saving it, and if the engine was running you could just go for a test drive at this point. However, if you wanted to make the test drive later you would need to save the changes before you shut the engine off or they would be lost. If you saved the changes but don’t want them after the test drive, you could still reedit or get rid of them entirely.

To practice saving changes, we will go through the steps for saving your data. **However, we will make the actual save to Data Set 0**. Saving to Data Set 0 always discards any changes and return the data set being edited to it’s unedited state, with no changes to any tables.

This section begins at the screen where you left off in the previous section, in the Fuel Table at the Part Throttle, Medium Load, 6000 RPM cell.

Prt ML 6000RPM F
Sv + 0% → Rn -8%

Pressing “ENTER" after making adjustments to any table, (Idle, PT, WOT, etc.) brings up the 'Select from menu:" screen.

Press: 

Select from menu:

Pressing 'ENTER" again at this point switches you out of the Edit mode and into the Monitor Mode. The Monitor Mode allows you to watch the fuel and timing commands as you drive, making road testing is more meaningful.

Note that when you leave the Edit mode that the active data set number on the Monitor mode screen is the number of the data set you were editing and does not necessarily correspond to the position of the PMS control knob. The data terminal remains in control of the active data set until after the ignition has been switched off and then back on again.

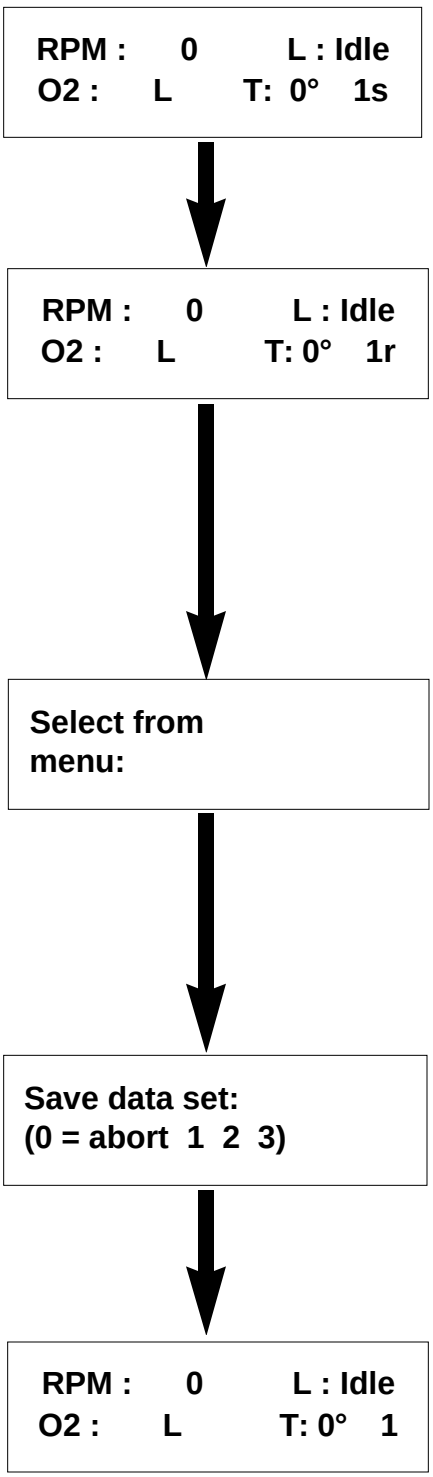
Press: 

RPM : 0 L : Idle
O2 : L T: 0° 1r

Before new data is saved the Monitor screen displays not only the Data Set which is active or being edited (in this case, #1, at the lower right), but also whether the original ("Sv") data or the new ("Rn") data is being used. The edited, or run (“Rn”), data is in use now, so the screen shows “r" next to the Data Set number. To compare the changes with the original Saved (“Sv”) data press “SAVE/TOG".

Press: 

(Display on following page)



When you do this, the “r” at the lower right changes to “s", indicating the engine is running on the Saved version of Data Set 1. (Before changes were made). Pressing 'SAVE/TOG" again switches back to the run (“Rn") data. If the engine were running now, you would feel the change in performance.

Press: SAV TOG

When you pressed 'SAVE/TOG", “r” replaced the 's" at the lower right, indicating the engine is running on the “Run” version of Data Set 1, the data with changes. After you evaluate the performance of the adjusted data, you can make further adjustments, save the new data, or discard the changes. All of these options are accessed from the “Select from menu:" screen, which can be accessed from any Monitor mode screen. Press “ENTER” to bring up “Select from menu:”.

Press: ENTER

You can save the changes to any Data Set. If this wasn’t a strictly practice exercise the most logical place to save the changes you just made would be to save them to Data Set 1. However, since we want to discard the practice data, save the changes to Data Set 0, which always discards any edited data.

Pressing the “Sav/Tog” key while at the “Select from menu:” screen will bring up the prompt “Select data set:”

Press: SAV TOG

Since we want to discard the edited data, Press “0,” followed by “ENTER.” This saves the data to Data Set 0, discarding it.

Had you wanted to save the changes to Data Set 1, 2, or 3 you would have pressed the appropriate number key, followed by “ENTER.”

Press: 0 + ENTER

After a Save operation, the PMS enters the Monitor Mode and makes the newly saved Data Set active. If you had saved the changes to Data Set 1, instead of Data Set 0,the PMS would have made data set No. 1 active. Notice that there is no longer any ”r" or “s” at the lower right of the screen. This is because the Saved and Run data for Data Set 1 are now the same.

When saving data keep in mind that **new data overwrites any existing information in the selected Data Set. Be sure to save any changes to the right data set or you may lose data you wanted to keep.**

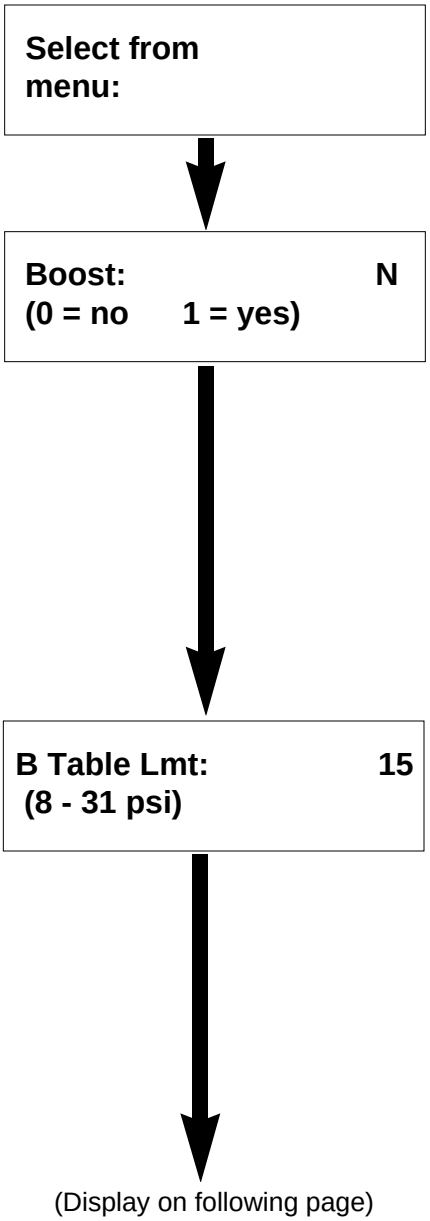
If the engine is running and you have made no changes to Vent Learn (the adaptive boost feature) you can proceed with a test drive at this point and all changes you did make will be in effect. If you made changes to Vent Learn you must turn the ignition Off**, WAIT 20 SECONDS,** then start your vehicle and make your test drive. The PMS will come up in the Monitor Mode with the Data Set selected by the control knob active. Select the data set you wish to try with the control knob, and proceed with your test drive.

Selecting the Performance Options

The PMS provides a high degree of tuning latitude, allowing the user to "dial in" the fuel calibration and ignition timing of engines equipped with superchargers, nitrous oxide, modified cylinder heads and high-performance camshafts. Keep in mind that calibrations are made in and for EACH Data Set, so you can have different settings for each one. However, this also means that if you want a set of calibrations to be active in more than one Data Set you must enter and save those calibrations separately in each Data Set you want them active in.

When a Performance Option screen is displayed the current value for each selection appears in the upper right corner. If that setting is not to be changed, press “ENTER” to cycle to the next available display.

To begin editing the Performance Options, enter it’s 3-digit code when “ Select from menu:” is displayed. In this case you want Menu Item 900, “Performance Options.”



(Display on following page)

Starting at the “Select from menu:” screen, press “900” (Performance Options), followed by “ENTER.”

Press: 9 0 0

Followed by: ENTER

The first screen displayed is “Boost.” **This option turns on all Boost features and should always be “On” for the Mitsubishi.** To turn Boost “On” press “1,” followed by “ENTER.” This will change the “N” (for No) in the display to “Y” (for yes). Press “ENTER” again to bring up the Boost Table Limit screen.

Press: 1

Followed by: ENTER ENTER

With Boost On (“Yes”) the Boost Fuel and Timing tables are used any time the boost exceeds 1 psi. (Boost Fuel and TIming Tables are Menu Item 600, page 30; they are not active unless Boost is turned on.)

If the Boost Control option is On the “B Table Lmt” (B=Boost) screen appears next. (If Boost is Off no boost-related screens will appear; the next screen up would then be the N2O screen.)

Enter the maximum boost pressure, 1 - 31:

1 – 3 1

Followed by: ENTER

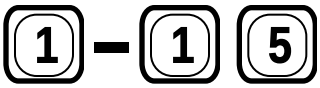
The Mitsubishi PMS is preprogrammed for a maximum boost of 15 - 19 psi, depending on the Data Set being edited. To change it, enter the maximum boost pressure, from 1 to 30 psi, followed by “ENTER.” This sets the upper limits of the Boost Fuel and Timing tables.

Leave the Boost Table Limit set at the value displayed by pressing “Enter.”

B Fuel Cut @ 17
(8 - 31 psi)

The next screen displayed is "Boost Fuel Cut." The value set here is the hard fuel cut; if the programmed boost pressure is exceeded for more than three seconds the fuel will be turned off until the boost pressure drops below this level; obviously the value entered here must exceed the maximum desired boost pressure. When the desired pressure has been set, press "ENTER."

Enter the boost fuel cut pressure, 1 - 15:



Followed by: ENTER

The rest of the screens on this page are available in Data Set 3 only; Data Sets 1 and 2 jump to "Vent Learn" screen at the bottom of the page.

Do Manual Vent
Adj? (1 = Yes)

"Do Manual Vent" allows you to manually enter the wastegate base number for each boost pressure. Determine by test driving if your boost pressure is reading less or more than the value you have set in the menu item 600 table for PSI@ XXXXRPM. If your boost is too high and the system will not adapt do the following:

Press "1," then "ENTER" at the "Do Manual Vent" screen.

Press: 1

Followed by: ENTER

Enter Boost XX
(8 - 31 psi)

1=Lower 2=Raise
XXPSI ## 1

Enter the boost value from menu item 600 (PSI@XXXXRPM), XX (ENTER). Press 2 to increase boost pressure or 1 to lower it. If your boost curve is inverted (too much boost at low RPM, too little boost at high RPM) you may need to turn "Vent Learn" off.

Test drive the car and repeat these steps for additional pressures; it will probably take a few acceleration runs for the system to adjust. To Exit press "ENTER." This will bring up the next screen, "Vent Learn."

Note: The number in the lower right of the "Raise/Lower Screen" is if no significance to you. It is a hexidecimal value used by the PMS itself in the adjustment process.

Enter Boost XX
(8 - 31 psi)

Press: ENTER

Vent Learn Y
(0=No 1=Yes

Vent Learn is for turbocharger wastegate control. Turning it on lets the boost control adapt to systems on the car that change with time and wear so that the pressures set under Menu Item 600 are actually achieved.

Press: 0 or: 1

Followed by: ENTER

(Go to next page)

A note on test-driving: Make controlled accelerations from 3000 to 6000 RPM at WOT; the boost should climb slowly to the desired value. In high-boost engines you may need to add a restricter to the MAP sensor hose to help with the pulsations that occur in boost levels above 20 psi. A.035 - .050 restriction is recommended; welding tips work well for this.

N2O **Y**
(0=No 1=Yes

The next screen is the "N2O" (Nitrous Oxide) screen. If the engine is equipped with nitrous oxide injection this option should be "On" so that the fuel and timing adjustments incorporated in the N2O tables (Menu Item 500) will be active when the nitrous system is activated. (For further information on the N2O feature see page 31.)

Press: 0 or: 1

Followed by: ENTER

NOTE: Even though "N2O" is turned on, **nothing will happen** unless the Nitrous Oxide Fuel and Timing Tables, Menu Item 500, are edited.

Stand Alone **N**
(0 = no 1 = yes)

The next screen, "Stand Alone" feature is used to bypass the factory rev limiter. To bypass the factory rev limiter turn Stand Alone "On." Stand Alone should also be on when using the optional InterAQ for Windows data acquisition and capturing program with the PMS.

Press: 0 or: 1

Followed by: ENTER

NOTE: If Stand Alone is **not** enabled this value cannot be in excess of the factory ECU's RPM limit as the factory RPM limit will occur first. With Stand Alone enabled the PMS can control the rev limit, **provided** the optional InterAQ for Windows program is used to load the PMS with the proper fuel and timing tables for the extended RPM range.

Max RPM: **XXXX**
(2200 - 9900)

The Max RPM screen is used to set a new maximum RPM limit. Enter the desired RPM between 2200 and 9900 RPM.

2 0 0 0 _
9 9 0 0

Followed by: ENTER

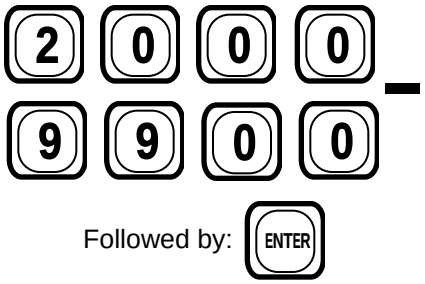
The following screen, for the Two-Stage Rev Limiter, **will not be displayed if the Two-Stage Rev Limiter has not been enabled in System Setup**. See "Two-Stage Rev Limiter Option, page 33. If this is not enabled, the next screen up will be the Acceleration Sensitivity (Accel Sens) screen.

(Go to next page)

2S Max RPM: XXXX
(2200 - 9900)

The next screen displayed is for the Two-Step rev limiter. Enter what rpm you want it to hold at and press "ENTER."

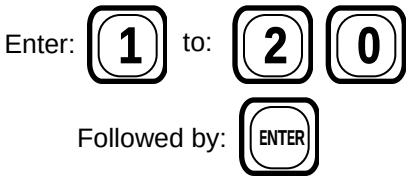
NOTE: To use the Two-Step Rev Limiter you must first add a wire to the N2O input that provides a switched 12V to the input to trigger the second Rev Limiter. In addition you must also have turned the option ON. Instructions for doing this are found under the Nitrous Oxide, Rev Limiter, and Two-Step Rev Limiter Options, Menu Item 500, page 31.



Accel Sens: XX
(01 - 20%)

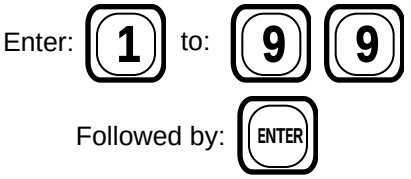
The Accelerator Sensitivity screen controls the sensitivity of the triggering to bring a specific set of fuel and timing tables into play when the throttle is opened. Like the accelerator pump on a carbureted car, this is to compensate for quick throttle openings. The number entered here is merely a value; the **lower** the number the **more** sensitive the trigger point is.

The fuel and timing tables for this feature are found in Menu Item 800, Temperature and Acceleration Compensation, page 35.



Accel Recvr: XX
(01 - 99)

The final screen displayed in Menu Item 900 is Acceleration Recover (Accel Recvr). This features gradually backs out and removes the acceleration compensation initiated in Accel Sens. The number here sets **the number of ignition events** to count the Menu Item 800 values back to zero. The **higher** the number, the **longer** the Item 800 adjustments will remain in effect.



Be sure to save your changes when you have completed setting up the Performance Options; the procedure is the same as for saving any Data Set. And don't forget to edit any related Fuel and Timing tables, such as the Boost (Menu Item 600, page 30), Nitrous Oxide (Menu Item 500, page 31), and Temperature and Acceleration Compensation (Menu Item 800, page 35).

Finally, keep in mind that the "Performance Options" selections apply **only to the Data Set being edited; not across the board.** If you want them in one or both of the other Data Sets, they must be entered in those Data Sets separately.

Tuning Tips -

- Have realistic expectations of your car's performance capabilities. With 93 octane fuel you can only expect to run around 17psi of boost, with spikes to 20psi; this works out to about 290HP.
- When you change to the 550cc injectors the idle will pick up a miss that cannot be tuned out because these injectors were not designed for 4-valve engines.
- You will be making most of your Boost Fuel adjustments in Menu Item 600 at 6000 and 7800 RPM, wide-open throttle (WOT). If you have to make Part Throttle adjustments, be sure you aren't chasing some other car problem.
- Tuning this system for your car is a trial and error procedure. We have done everything possible to make it as easy as we can. Have patience, and if you don't understand some thing don't hesitate to ask us as this can only help to make the product better. You can contact us by phone, fax, or via our web site **www.efisystems.com**

The Boost Option - Menu Item 600

When you selected the Boost feature in "Performance Options" you were asked to enter a boost table limit in psi. This customizes the PMS Boost tables to your specific application. The Boost Fuel and Timing tables, shown below, allow you to specify fuel and timing adjustments at 1 psi boost and at maximum boost for each RPM range. The ranges shown in the boxes indicate the range of adjustment available.

Boost Fuel Adjustments (± 2% Steps)				
RPM	2200	4000	6000	7800
1 psi	-100% to +250%	-100% to +250%	-100% to +250%	-100% to +250%
Boost Table Limit	-100% to +250%	-100% to +250%	-100% to +250%	-100% to +250%

Boost Timing Adjustments (± 1° Steps)				
RPM	2200	4000	6000	7800
1 psi	-25° to +25°	-25° to +25°	-25° to +25°°	-25° to +25°
Boost Table Limit	-25° to +25°	-25° to +25°	-25° to +25°	-25° to +25°

Boost Pressure (psi)				
RPM	2200	4000	6000	7800
Pressure psi	1 - 31	1 - 31	1 - 31	1 - 31

When Menu Item 600 is selected the Boost Fuel, 2200 RPM screen will appear. Edit it as in any other table, then move through the other RPM ranges and the Timing and Pressure tables by using Quick Key II (RPM) and Quick Key III (Table) as appropriate.

For boost levels between 1 psi and the maximum the PMS "interpolates", or splits the difference between the adjustments. For example, if maximum boost is 9 psi and you entered +10% fuel at 1 psi and +30% at maximum boost, then at 5 psi (halfway between 1 psi and maximum) the fuel adjustment would be +20%. If the boost goes beyond the max value you set, the PMS will continue to use the fuel and timing adjustments in the Boost Table Limit row of the tables. (Note: Boost pressures above 30 psi may permanently damage the boost sensor.)

Typical practice in boosted applications is to richen the fuel mixture and reduce the total spark advance to guard against detonation; you will need to experiment to find the proper balance of boost pressure, fuel, and timing to maximize performance without damaging your engine.

Some important points to remember are:

- ✔ The Boost Fuel and Timing tables are only activated when:
  - The Boost feature is selected (turned ON) in the active Data Set,
    AND
  - The boost pressure in the manifold exceeds 1 psi
- ✔ The Boost fuel and timing adjustments are added to any Part Throttle, WOT, and N_20 adjustments which may apply
- ✔ Any fuel adjustment beyond the capability of your injectors {F: MAX on the Air/Fuel Monitor Mode) will have no effect.

The Nitrous Oxide Rev Limiter, and Two-Step Rev Limiter Options - Menu Item 500

Terminal number B3 in the plug connecting the PMS wiring harness to the PMS CPU (see drawing of plug, following page) is used to activate the N_2O Fuel and Timing tables. The N_2O tables become active when 12 volts is applied to this terminal and the N_2O feature is selected in the active Data Set.

To use this feature wire the +12V side of the nitrous oxide solenoid to the PMS accessory plug. That way, every time you "hit the bottle" the N_2O adjustments are applied.

Nitrous Oxide Fuel Adjustments (± 2% Steps)				
RPM	2200	4000	6000	7800
N_2O On	-100% to +250%	-100% to +250%	-100% to +250%	-100% to +250%

Nitrous Oxide Timing Adjustments (± 1° Steps)				
RPM	2200	4000	6000	7800
N_2O On	-25° to +25°	-25° to +25°	-25° to +25°	-25° to +25°

When Menu Item 500 is selected the Nitrous Oxide Fuel, 2200 RPM screen will appear. Edit it as in any other table, then move through the other RPM ranges and the Timing table by using Quick Key II (RPM) and Quick Key III (Table) as appropriate.

Like the Boost Fuel and Timing Tables, the values in the cells above indicate the range of adjustment available. And also like the Boost Fuel and Timing tables, **N_2O adjustments are made on top of any other adjustments which might be active** (such as WOT). For instance, if you had programmed a WOT, 4000 RPM timing adjustment of +6° and a N_2O, 4000 RPM timing adjustment of -8°, activating the nitrous system at wide-open throttle and 4000 RPM will result in a net timing adjustment of -2°. (+6° -8° = -2°.)

The N_2O connector can be used for things other than nitrous oxide. Any event requiring a change in fuel and timing can be accommodated by applying 12V to this connector. In turbocharged applications, for example, an over-boost switch could be used to add fuel and reduce spark advance at a specified manifold pressure.

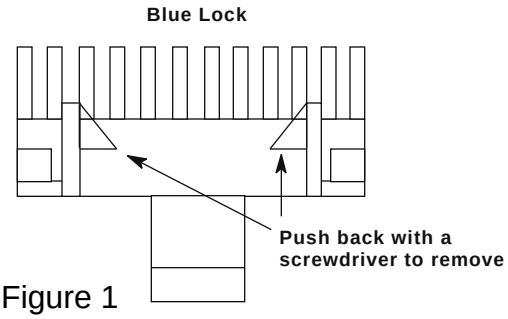


Figure 1

Notes:

1. The terminal for this connector is NAPA P/N 725159.
2. Terminal B3 is for using the N_20 option; the +12V wire from the N_20 solenoid is connected to the PMS through terminal B3.

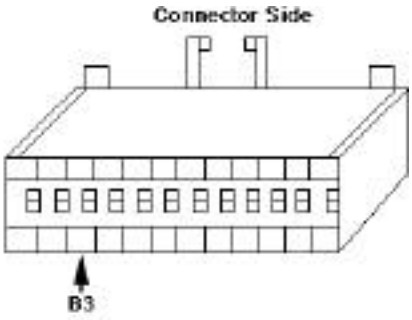


Figure 2

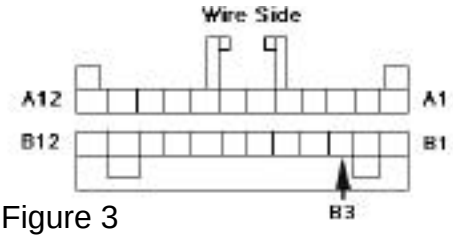


Figure 3

The PMS Rev Limiter Options

The PMS Rev Limiter works by cutting off the pulses to the fuel injectors at the specified RPM. The Rev Limiter may be set as low as 2200 RPM and as high as 9900 RPM. The primary reason for using the Rev Limiter feature on the Mitsubishi is to lower the RPM limit, as you might want to do to decrease the performance available to inexperienced drivers or to keep unsupervised drivers such as parking lot attendants from having too much fun.

To set the RPM limit in excess of that determined by the factory ECU, two things must be done. First the Stand Alone feature of the PMS must be enabled. Second, the optional InterAQ for Windows software must be used to load appropriate fuel and timing tables to support the engine's operation above the stock RPM limit. If the RPM limit is set in excess of the factory limit on the PMS without both of these items, the factory rev limit will occur first.

The fuel cut-off type rev limiting used by the PMS is preferable to spark-only rev limiters for general street use. Spark-only limiters allow unburned fuel to wash the oil film from the cylinder walls. Over time this can spell trouble for a street-driven vehicle.

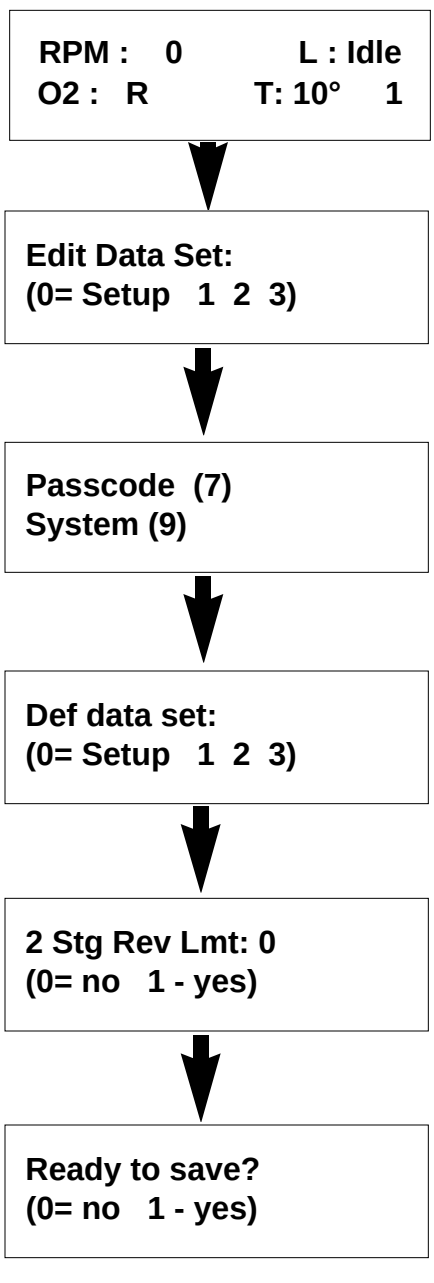
The fuel cut-off type rev limiter does have some limitations. It is ineffective on vehicles equipped with an additional, independent fuel source such as a nitrous fogger nozzle or auxiliary injectors. Rev limiting will not be effective where additional fuel sources are present.

The PMS Two-Step Rev Limiter -

The Two-Step Rev Limiter allows you to set two RPM limits; a lower one to “spool the car up” against and the normal high rev limit. This allows you to have maximum power right away, “out of the hole,” as needed in drag racing applications.

To use the Two-Step Rev Limiter you must first provide a switched 12V to terminal B3 of the PMS CPU as noted in the N2O option above. The switch may be in the form of a push button, a clutch-activated switch, or whatever you choose. When 12V is applied (i.e. switch closed) to the terminal the first step of the rev limiter is activated. When the 12V is removed (switch open) the second step of the rev limiter becomes active. In addition you must also enable the Two-Step Rev Limiter option on by doing the following:

With the key on and the engine not running:



Begin by selecting a data set to enter. Pressing “ENTER” will bring up the screen “Edit Data Set.”

Press: ENTER

Select “0” =Setup,” followed by “ENTER.”

Press: 0

Followed by: ENTER

This will bring up the “Passcode/ System” screen. Select System (9)

Press: 9

Followed by: ENTER

When the “Define Data Set” screen appears, enter “1.”

Press: 1

Followed by: ENTER

This will bring up the “2 Step Rev Limit” screen. To activate the 2-Step Rev Limiter enter “1.” (Yes)

Press: 1

Followed by: ENTER

You will then be prompted by the “Ready to Save?” screen. Press “1” for Yes.

The Two-Step rev limiter is now enabled. Turn the key off.

Once the Two-Step Rev Limiter is enabled the N2O feature is disabled; they cannot be used together. To trigger the Two-Step Rev Limiter apply 12V to the N2O input (see above) and it will instantly hold the rpm to the preset value until the 12V input is removed. Because this creates high exhaust gas temperatures it isn't recommended to hold this first stage RPM for longer than 10 seconds.

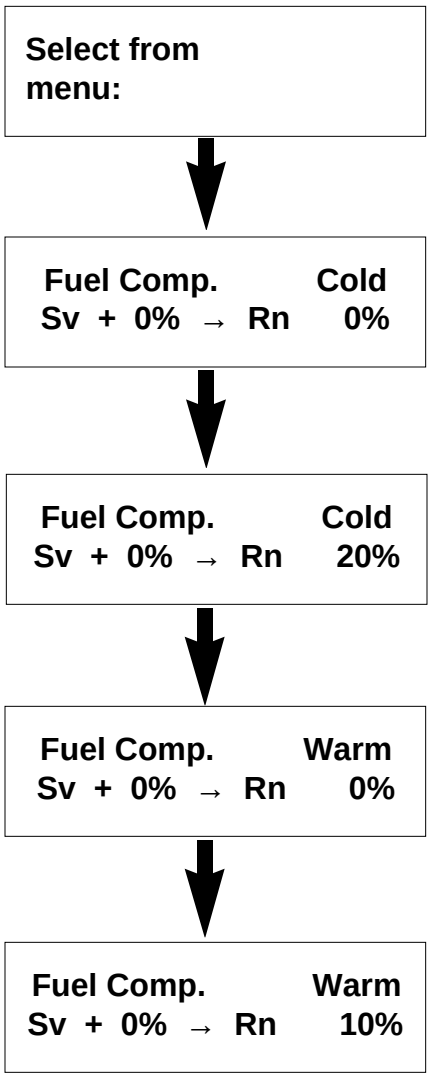
Temperature and Acceleration Compensation - Menu Item 800

Temperature compensation allows you to make an adjustment in fuel mixture for increased driveability while the engine is warming up. It allows you to enter a percentage of fuel, plus or minus, for when the engine is "cold", and a second percentage for when the engine is "warm." "Cold" is defined as less than 30°F, and "Warm" is approximately 130°F.

When fuel compensation is activated by entering values in the tables, and the engine temperature is under 30°F., the fuel tables will be modified by the Temperature Compensation value. The PMS interpolates between the cold compensation and warm compensation values until the warm value is reached. Warm compensation then tapers off until there is no compensation remaining after approximately 180°F.

Acceleration Compensation provides fuel and timing adjustments when the throttle is rapidly opened - rather like a carburetor's accelerator pump. This compensation is then automatically "backed out." The sensitivity of the tip in and speed of backout are set on the Acceleration Sensitivity and Acceleration Recover screens in Menu Item 900.

To use Temperature and Acceleration Compensation enter "800" at the "Select from Menu:" screen.



At the "Select from Menu:" screen press "8-0-0, " followed by "Enter."

Press: 8 0 0

Followed by: ENTER

The first screen to be displayed will be the "Fuel Comp. Cold" screen. Enter the percentage change you desire, as in editing any Fuel Table. For example, in this case lets add 20% fuel. Press "2-0," followed by "Enter."

Press: 2 0

Followed by: ENTER

To change to the "Fuel Comp. Warm" screen press Quick Key I

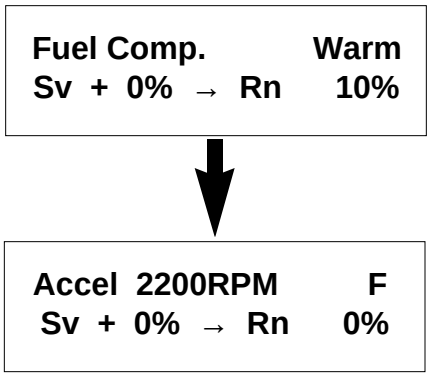
Press Quick Key I: I

Enter the value for warm compensation; for example enter 10%

Press: 1 0

Followed by: ENTER

That completes Temperature Compensation set-up. To set up the tables for Acceleration Compensation :



Press Quick Key II; this will bring up the first Acceleration Compensation screen.

Enter the desired value for fuel compensation at 2200 RPM, then press "ENTER."

Press Quick Key I 

Note that the Acceleration Compensation tables work exactly like the other Fuel and Timing tables (Idle, Part Throttle, WOT, etc.) introduced earlier and are edited in the same way. Use **Quick Key II** to continue cycle through and edit, if necessary, the 4000, 6000, and 7800 RPM data points. Then use **Quick Key III** to switch to the Acceleration Compensation Timing Tables and do the same thing.

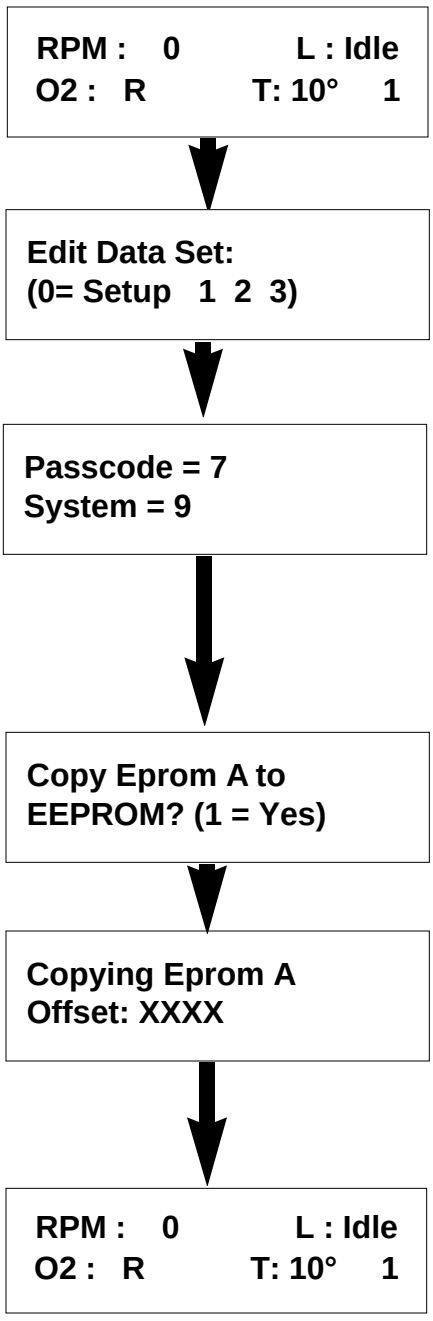
When you have finished, save your changes and exit the Edit mode as in editing operation. And, as with the other tables, these changes are specific to a given Data Set. They must be made and saved in each Data Set you want them active in.

Appendix A - Restoring the Original Data

In the event you need to reinstall the original, as-shipped data in your PMS, or if you are changing from 435cc to 550cc injectors (or vice-versa), do the following:

1. Turn on the ignition, but **do not** start the engine.

Then:



Editing starts by pressing "ENTER." This will bring up the screen "Edit Data Set:"

To Setup the unit, press "0,"=Setup, followed by "ENTER."

This will bring up the "Passcode/ System" screen. Even though it is not shown as a screen option, press either "1" or "2," followed by "ENTER."

"1" =New Data Setup 1
(435 injectors)
OR
"2"= New Data Setup 2
(550 injectors

Pressing "1" or "2" above will bring up the screen at left. Press "1" to begin copying the new data to the EEPROM.

It will take about 45 seconds for the updating process to be completed. During this time the screen at left will be displayed. ("XXXX" represents changing numbers flashing on the screen.

When updating is completed, press "ENTER." All of the fuel and boost values are now reset and the PMS returns to the Monitor mode.

Exit the Monitor Mode and select a Data Set to Edit, Press: ENTER

Select Setup by entering:

0 followed by: ENTER

1 or 2

followed by:

ENTER

Press 1

followed by:

ENTER

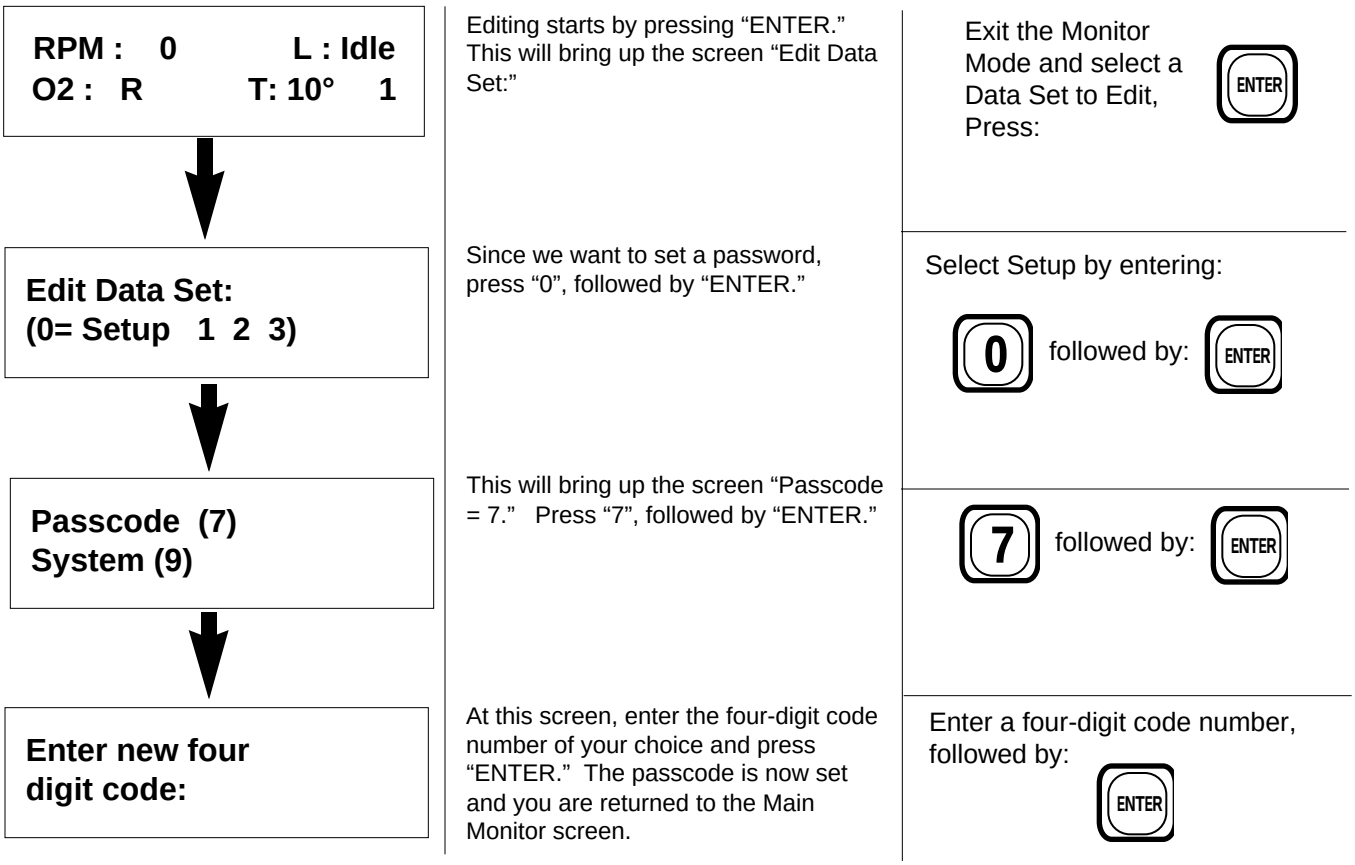
Press ENTER

Appendix B -
Using the Passcode Feature

The PMS incorporates a Passcode feature, for those who wish to use it, so that the data sets cannot be edited until after a four-digit Passcode of your choosing is entered.

An example of why you might want to use this feature would be where you are in a competition situation where some of the other competitors are also familiar with the PMS. Without passcode protection they could use your data terminal (or theirs!) to alter your Fuel and Timing tables to make you less competitive, or even damage your engine.

To activate and use the Passcode feature, start the engine and begin like you are going to edit a data set. T**he engine must be running to activate or modify the passcode**. When the engine is started the PMS automatically enters the Main Monitoring mode. Then:



With the passcode set, whenever anyone tries to select from the "Edit Data Set" menu a screen will appear asking them to enter the four-digit passcode. If the correct passcode is entered, the PMS will allow the selected data set to be edited. But if the correct passcode is not entered, the PMS returns to the "Edit Data Set" screen and will not allow editing.

The passcode will also prevent switching data sets, but only from the data terminal. It has no effect on switching data sets with the control knob.

To cancel a previously-set password and disable the feature, enter passcode "0000."

Appendix C -
Self Diagnostics

The PMS includes onboard diagnostics, not only for itself but for many of your vehicle's most important sensors and outputs. When the PMS detects a problem, it generates a Trouble Code which can be displayed on the terminal screen. Trouble Codes are accessed through the Accessory Monitor screen. Note: Trouble Codes are not stored, so they are erased when the ignition key is turned "OFF".

RPM : 0	**L : Idle✻**
O2 : L	**T: 0° 1**

MP : -21.3	**N2O: Off**
ACC: 00	**E: XXXX**

An asterisk (✻) in the upper right corner of the Main Monitor screen indicates a Trouble Code is present. To view the code, press Quick Key III to bring up the Accessory Monitor Mode screen.

The Trouble Code value, denoted here by "XXXX" will appear in the lower right of this screen. Write the code down, since it will be erased when the key is turned OFF. The Trouble Code may also be viewed on the "Select from menu" screen during editing.

Press Quick Key III: 

Press Quick Key I: 

To return to the Main Monitor Mode

Each of the four Trouble Code digits covers four possible problems, or faults, for a total of 16. However, each of the four problems for a given digit may or may not be present, or occur in any combination. Thus, each of the digits in the Trouble Code must allow for the 16 ways that the four faults may occur.

For Each Digit:
1 = Problem #1
2 = Problem #2
3 = Problems #1 & #2
4 = Problem #3
5 = Problems #1 & #3
6 = Problem #2 & #3
7 = Problems #1,#2, &#3
8 = Problem #4
9 = Problems #1 & #4
A = Problems #2 & #4
B = Problems #1, #2, & #4
C = Problems #3 & #4
D = Problems #1, #3, & #4
E = Problems #2, #3, & #4
F = Problems #1, #2, #3, & #4

First Digit Problems:	Second Digit Problems:
#1 = Missing MAP Signal	#1 = Spark input fault
#2 = Missing Mass Air Signal	#2 = Spark output fault
#3 = Missing Water Temp Signal	#3 = Fuel injector input fault
#4 = Missing TPS Signal	#4 = Fuel injector output fault

Third Digit Problems:	Fourth Digit Problems:
#1 = False interrupt	#1 = Stack overflow
#2 = False reset (or low voltage)	#2 = Invalid EPROM checksum
#3 = High speed input problem	#3 = Invalid EEPROM checksum
#4 = High speed output problem	#4 = RAM (memory) problem

For example, consider Trouble Code "0300". Since the first, third and fourth digits are zero, none of the problems associated with those digits is present (see table). Looking at the table, a "3" in the second position means that Problems # 1 and # 2 are present.

These problems are spark input fault and spark output fault. The most likely cause of this combination of faults is a loose or disconnected distributor harness connector. Remember, Trouble Codes are erased when the key in turned to "OFF".

Appendix D -
Frequently Asked Questions About the PMS

Q. How do I check the air/fuel ratio to see if it is rich or lean?
A. The O_2 voltage displayed on Monitor Screen 2 gives a good general indication of mixture. A value between .62 and .82 at WOT is about right. However, if the engine has a misfire the O_2 numbers will not be accurate because of the unburned fuel.

Q. At idle or part throttle the O_2 voltage varies; why is this happening?
A. This is a result of the closed loop operation of the system. The stock computer is trying to maintain a 14.7:1 air/fuel ratio. It adjusts the mixture 30 times a second, and what your are seeing is the result of this mixture change as reflected in the O_2 voltage readings.

Q. If I add fuel during idle or part throttle it just seems to relearn it why?
A. This again is closed loop in operation. The stock computer has a window of about ±20% fuel that it can adjust in. Any adjustment you make that falls within this window will be changed by the stock computer in an effort to maintain the 14.7:1 ratio. Any adjustments made here should be in an attempt to cause the computer to go closed loop for optimum fuel mileage and emissions.

Q. Will it relearn at WOT too?
A. No. Any adjustments made at high load or WOT will be added to the total. This is what's known as open loop. You will notice the O_2 voltage fluctuates more slowly under these conditions.

Q. Will the settings be lost if I disconnect the battery?
A. No, the PMS stores your program in a special chip that doesn't lose its memory when the power is removed.

Q. I moved the battery from its original location. Now I get error code 0020 at startup.
A. When you moved your battery you changed the power and ground paths; sometimes this causes a voltage drop. That's what the 0020 code is indicating . You can help this by adding a 12# wire from the positive battery terminal to the ECU relay's 12V source. This code doesn't cause any problems except during starting.

Q. Sometimes I get 0200 code but my car runs fine. What should I do?
A. In an effort to check all systems the PMS ECU counts incoming sparks versus outgoing sparks and sometimes, either because of multi - spark ignition or leaky plug wires, it counts an extra spark. This usually doesn't cause a problem.

Q. The PMS permits adjustments at 2200, 4000, and 6000 rpm. What happens in between these points?
A. The PMS software averages the difference between adjacent set points . Example: 2200 rpm = 10%, 4000 rpm = 20%. At 3000 rpm it would be half way between 2200 and 4000, so the adjustment would be 15%. The same averaging is used between LLoad, MLoad, HLoad.

Appendix E -
Your Own Data Table Worksheets

These worksheets are for your use in modifying the PMS data tables and keeping a record of what you have done.

Data Set No. 1 -

Idle Fuel Adjustment (± 2% Steps)

Part Throttle Fuel Adjustment (± 2% Steps)				
RPM	2200	4000	6000	7800
Light Load				
Med. Load				
High Load				

Part Throttle Timing Adjustment (± 1° Steps)				
RPM	2200	4000	6000	7800
Light Load				
Med. Load				
High Load				

Wide-Open Throttle (WOT) Fuel Adjustment (± 2% Steps)				
RPM	2200	4000	6000	7800
High Load				

Wide-Open Throttle (WOT) Timing Adjustment (± 1° Steps)				
RPM	2200	4000	6000	7800
High Load				

Boost Fuel Adjustment (± 2% Steps)				
RPM	2200	4000	6000	7800
1 psi Boost				
Boost Table Limit				

Boost Timing Adjustment (± 1° Steps)				
RPM	2200	4000	6000	7800
1 psi Boost				
Boost Table Limit				

Nitrous Oxide Fuel Adjustment (± 2% Steps)				
RPM	2200	4000	6000	7800
N_2O On				

Nitrous Oxide Timing Adjustment (± 1° Steps)				
RPM	2200	4000	6000	7800
N_2O On				

Boost Feature		
ON	☐	Maximum Boost
OFF	☐	psig

Rev Limiter Feature		
ON	☐	Maximum RPM
OFF	☐	RPM

N2O Feature	
ON	☐
OFF	☐

Appendix E -
Your Own Data Table Worksheets

Data Set No. 2 -

Idle Fuel Adjustment (± 2% Steps)

Part Throttle Fuel Adjustment (± 2% Steps)				
RPM	2200	4000	6000	7800
Light Load				
Med. Load				
High Load				

Part Throttle Timing Adjustment (± 1° Steps)				
RPM	2200	4000	6000	7800
Light Load				
Med. Load				
High Load				

Boost Fuel Adjustment (± 2% Steps)				
RPM	2200	4000	6000	7800
1 psi Boost				
Boost Table Limit				

Boost Timing Adjustment (± 1° Steps)				
RPM	2200	4000	6000	7800
1 psi Boost				
Boost Table Limit				

Nitrous Oxide Fuel Adjustment (± 2% Steps)				
RPM	2200	4000	6000	7800
N2O On				

Nitrous Oxide Timing Adjustment (± 1° Steps)				
RPM	2200	4000	6000	7800
N2O On				

Nitrous Oxide Fuel Adjustment (± 2% Steps)				
RPM	2200	4000	6000	7800
N_2O On				

Nitrous Oxide Timing Adjustment (± 1° Steps)				
RPM	2200	4000	6000	7800
N_2O On				

Boost Feature		
ON	☐	Maximum Boost
OFF	☐	psig

Rev Limiter Feature		
ON	☐	Maximum RPM
OFF	☐	RPM

N2O Feature	
ON	☐
OFF	☐

Appendix E -
Your Own Data Table Worksheets

Data Set No. 3 -

Idle Fuel Adjustment (± 2% Steps)

Part Throttle Fuel Adjustment (± 2% Steps)				
RPM	2200	4000	6000	7800
Light Load				
Med. Load				
High Load				

Part Throttle Timing Adjustment (± 1° Steps)				
RPM	2200	4000	6000	7800
Light Load				
Med. Load				
High Load				

Wide-Open Throttle (WOT) Fuel Adjustment (± 2% Steps)				
RPM	2200	4000	6000	7800
High Load				

Wide-Open Throttle (WOT) Timing Adjustment (± 1° Steps)				
RPM	2200	4000	6000	7800
High Load				

Boost Fuel Adjustment (± 2% Steps)				
RPM	2200	4000	6000	7800
1 psi Boost				
Boost Table Limit				

Boost Timing Adjustment (± 1° Steps)				
RPM	2200	4000	6000	7800
1 psi Boost				
Boost Table Limit				

Nitrous Oxide Fuel Adjustment (± 2% Steps)				
RPM	2200	4000	6000	7800
N_2O On				

Nitrous Oxide Timing Adjustment (± 1° Steps)				
RPM	2200	4000	6000	7800
N_2O On				

Boost Feature		
ON	☐	Maximum Boost
OFF	☐	psig

Rev Limiter Feature		
ON	☐	Maximum RPM
OFF	☐	RPM

N2O Feature	
ON	☐
OFF	☐