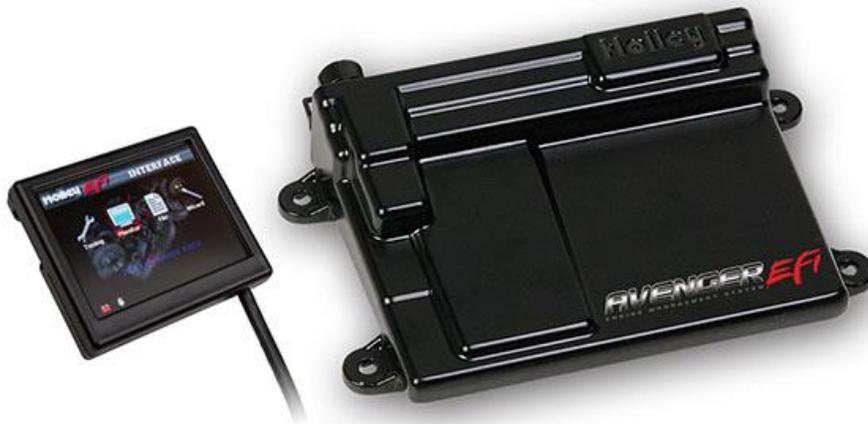




Avenger ECU & Handheld Setup and Tuning



EFI
MADE EASY!

Instructions and Tuning Guide 199R10505

NOTE:

These instructions must be read and fully understood before beginning installation. If this manual is not fully understood, installation should not be attempted. Failure to follow these instructions, including the pictures may result in subsequent system failure.

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1.0 INTRODUCTION

Holley Performance Products has written this manual for the installation of the **Avenger ECU & Handheld** system. Please read all the **WARNINGS, NOTES, and TIPS**, as they contain valuable information that can save you time and money. It is our intent to provide the best possible products for our customer; products that perform properly and satisfy your expectations. Should you need information or parts assistance, please contact our technical service department at 1-270-781-9741, Monday through Friday, 8 a.m. to 5 p.m. Central Time. By using this number, you may obtain any information and/or parts assistance that you may require. Please have the part number of the product you purchased when you call.

NOTE: This manual is for the setup and tuning of the Avenger EFI system. Installation of the ECU, wiring, Avenger Handheld, and all EFI system hardware (throttle body, sensors, fuel system) is covered in the “Hardware Installation Manuals” included with your system as a separate document.

NOTE: This document covers basic tuning information, for advanced tuning information please go to http://documents.holley.com/techlibrary_199r10751.pdf

NOTE: No laptop computer is required for the installation and tuning of the Avenger system.

SMALL BLOCK CHEVY NOTE: These kits require the use of a small diameter distributor, such as a small cap GM HEI or most MSD distributors. A large cap GM HEI will not fit with these kits.

WARNING! The **AVENGER EFI** systems consist of a number of sophisticated components. Failure of any one component does not constitute, nor does it justify, warranty of the complete system. Individual service items are available for replacement of components. If assistance is required or if you need further warranty clarification, you can call Holley Technical Service at the number shown above.

WARNING! To preserve warranty, these instructions must be read and followed thoroughly and completely before and during installation. It is important that you become familiar with the parts and the installation of the **AVENGER EFI** system before you begin. Failure to read and understand these instructions could result in damage to **AVENGER EFI** components that are not covered by the warranty and could result in serious personal injury and property damage.

WARNING! Failure to follow all of the above will result in an improper installation, which may lead to personal injury, including death, and/or property damage. Improper installation and/or use of this or any Holley product will void all warranties.

2.0 WARNINGS, NOTES, AND NOTICES

WARNING! Once the vehicle is started, make sure that you have no fuel system leaks.

3.0 PREVIOUS INSTALLATION REQUIRED

At this point, the installation of your EFI system should be 100 percent complete. The ECU, Avenger Handheld controller, throttle body and intake hardware, all sensors, wiring, fuel pump, regulator and return line, and all other hardware should be installed. The vehicle should be ready to start and run. If this is not the case, refer to the hardware installation manual included with your particular system.

4.0 AVENGER INSTRUCTIONS AND TUNING

The Avenger EFI systems are designed to be easy to use for the first time EFI tuner. The instructions are set up in that manner as well. These instructions will not get into detail about EFI theory and operation. They will provide the steps necessary to get you up and running quickly. The Avenger system allows for the user to perform some basic changes to the tuning *if they desire to do so*. The instructions are sequenced to get you up and running so you can enjoy your vehicle, then review some of the parameters that can be adjusted to fine tune your vehicle at a later time if desired.

Turn the ignition key to the “run” position. This should apply power to the ECU as well as the Avenger Handheld control module. The handheld should power up and the Home Screen (**Figure 1**) should appear.

The Home screen contains icons which will navigate to different functional features of the 3.5” Touch Screen. These features will be discussed in detail throughout this manual.



Figure 1 – Home Screen

NOTE: DO NOT ATTEMPT TO START THE VEHICLE UNTIL YOU ARE TOLD TO DO SO IN THE INSTRUCTIONS BELOW.

NOTE: The handheld has a SD memory card installed in the side. This card contains specific information that is required for the use of the Avenger product. DO NOT replace this card with another. There should be no need to remove this card for normal use.

5.0 HANDHELD NAVIGATION & USE

The 3.5” handheld utilizes a touch screen display. All navigation is done through “touching” an icon or button on the screen. The following is an overview of the different types of adjustment screens that are used in the display, and that may be utilized when tuning or making selections.

5.1 Making Adjustments

Slider Bar: Slide the bar left or right with the stylus, or use the right and left arrow keys for fine adjustment (**Figure 9**).

List: Use the scroll bar on the right hand side of the screen to view all list entries. Touch the desired list item and click ‘OK’ to make a selection (**Figure 10**).

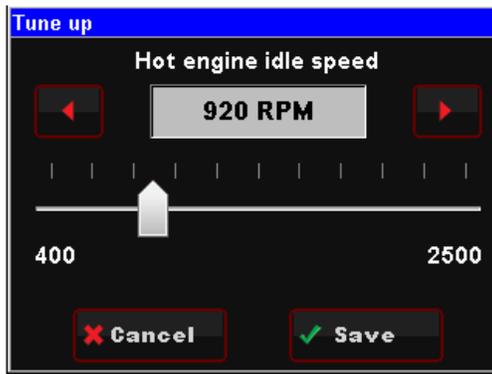


Figure 2 – Slider Bar

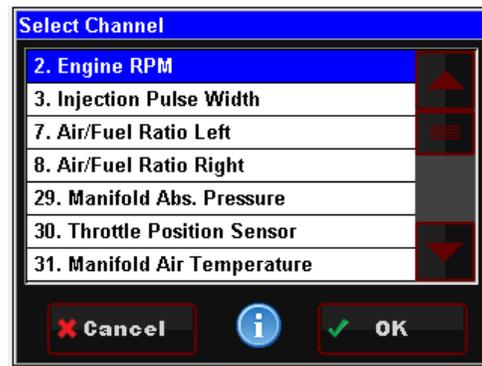


Figure 3 – List

On Screen Prompts: Follow the on screen text and use buttons at the bottom of the screen to continue or confirm.

6.0 HOME SCREEN

The HOME SCREEN has 4 selections (**Figure 4**). They are explained in more detail later in the instructions.

TUNING – Allows for various parameters to be easily adjusted.

MONITOR – A variety of gauge and dash displays.

FILE – Saves and loads files. Also shows information about the ECU and handheld controller.

WIZARDS – Creates a base calibration and performs the “TPS Autaset” function.



Figure 4

7.0 CALIBRATION WIZARD

The first step is to create an initial calibration using the WIZARDS located on the HOME SCREEN.

1. Select WIZARDS
2. Select START GCF WIZARD (**Figure 5**)
3. The Wizard process will guide you through each selection step. There will be a question at the top. Select the proper response and select “Next” at the bottom. Selecting “Home” at any time will cancel the process.
4. Next, select “Holley TBI” (for Throttle Body Injection Systems) or “Holley MPFI” (for Multiport EFI Systems) for the system type (**Figure 6**)
5. Next, select what type of system you have.



Figure 5



Figure 6

6. If your engine is up to 409 cubic inches, select “Up To 409 CID”. If your engine is larger than 409 cubic inches, select “410 CID and Larger” (**Figure 7**).
7. The next choice should be dictated by the camshaft size and characteristics (**Figure 8**). If you have no idea, just simply select “Don’t Know”.

The choices are further defined as:

- “Street Strip” – Camshafts with over 225 degrees duration at .050” valve lift (225°@.050”).
- “Mild Street” – Engines with non-stock camshafts that have between 214-224 degrees duration at .050” valve lift (214°-224°@.050”).
- “Factory Stock” – Engine that have a stock, factory camshaft, or aftermarket camshafts that have a duration BELOW 214 degrees at .050” valve lift (below 214°@.050”).
- “Don’t know” – If you have no idea as to what type of camshaft is in your engine, choose this selection.

NOTE: If you are not sure of the camshaft size, it is best to select “Don’t know”.



Figure 7



Figure 8

8. Next, you need to select whether the ECU will be controlling the ignition timing (**Figure 9**). Select “Yes” ONLY if you are using a GM small cap computer controlled HEI distributor. This is the only distributor that allows the ECU timing control using the AVENGER™ MPFI systems. All other ignition/distributor types must be a standard mechanical advance type used on any carbureted application. If you select “Yes”, proceed to step 10. If you select “No”, proceed to step 9.



Figure 9



Figure 10

9. If you are not controlling timing, you will have the following two choices. It is important the correct item is selected, as well as to double-check that you used the proper input wire when the vehicle was wired.

“Coil – (neg)-” – Select this if you are NOT using an aftermarket Capacitive Discharge (CD) ignition box such as a MSD, Mallory, or others. This is for stock, factory inductive ignition coils. Examples would be a factory GM large cap HEI, or a points style ignition with a canister coil. You should have connected the solid yellow wire in the harness to the negative side of the ignition coil when the wiring was performed.

“CD Box Tach Out” – Select this if you are using an aftermarket Capacitive Discharge (CD) ignition box such as a MSD, Mallory, or others. When you wired the vehicle, you should have used an ignition adapter harness that had a yellow/black wire that you connected to the “tach out” on the ignition box. Nothing should have been wired directly to the ignition coil.

NOTE: If you are unsure of this selection, or wiring, contact Holley tech service. Damage to the ECU will result due to improper wiring.

10. After entering the ignition type, your calibration will be created. Press the “Upload” button to send the calibration to the ECU (Figure 10). You will then see a screen showing “Uploading”. Finally you will see a screen indicating the file is uploaded (Figure 12). Cycle the ignition switch for the calibration to take effect.



Figure 11

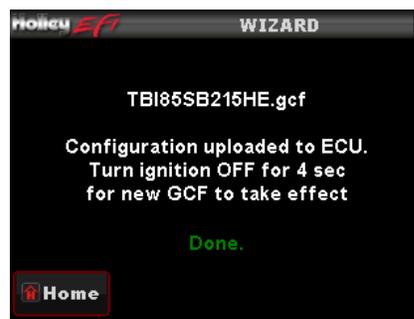


Figure 12

8.0 TPS AUTOSET

The next step is to perform a “TPS Autaset”. This must be done with the vehicle ignition power on. **This must be done on a brand new system otherwise the injectors and ignition will not be fired by the ECU.** A TPS Autaset programs the ECU with the full travel/voltage range from idle to wide open throttle for the Throttle Position Sensor (TPS). The TPS Autaset function is found under the “WIZARDS” choice under the HOME SCREEN. Select “START TPS AUTOSET”. Follow the prompts. You can select “Home” at any point to stop the process. If everything is successful, you will see a TPS Autaset Successful message.



Step 1: Select TPS Autaset



Step 2



Step 3



Step 4: Select 'Done'

9.0 SENSOR VERIFICATION

Before starting the vehicle, verify that all of the sensors are reading properly. At this time, turn the key off, and cycle it back on. At this time you should hear the fuel pump come on and run for 5 seconds. Check for fuel leaks at this time as well.

On the HOME SCREEN, select the MONITOR tab. This will bring up various options. Select the “Monitors” screen. You will see a screen called “Sensors”. Select this. With the key on and the engine off, these sensors should read as follows:

- **MAP** (Manifold Air Pressure Sensor) – Should read from 95-102. At high elevations it could read as low as 75.
- **TPS** (Throttle Position Sensor) – Should read 0. Slowly depress the throttle to wide open. It should read 100 at wide open throttle. If it reads 1-2, you may want to lower the idle screw on the throttle body.
- **MAT** (Manifold Air Temperature Sensor) – reads current air temperature
- **CTS** (Coolant Temperature Sensor) – reads engine temperature. If the engine is “cold”, it should read almost the same as the MAT sensor.
- **Battery** – Will read battery voltage. Should be 12.0 volts minimum.

If ANY of these sensors are not reading properly, this must be resolved before the engine is started.

10.0 STARTUP

The vehicle should be ready to be started. Open the sensors screen. Make sure the TPS is reading 0. If it does not, do a TPS AUTOSET, or if it is reading 1-2%, close the idle screw on the throttle body slightly.

Crank the engine and look at the RPM parameter. It should change to “Syncng”, indicating the ECU is syncing with the RPM signal for an instant, then show an RPM signal. The engine should fire and run and come to an idle.

If you do not get an RPM signal, there is an error in the wiring or system setup. Call Holley Tech service for advice.

If the engine starts but is idling too low and appears to be struggling for air, you may have to open the throttle body idle speed screw at this time. If you move the screw, you will need to perform a TPS Autotest.

11.0 SETTING IGNITION TIMING

If you are using a computer controlled GM HEI or Ford TFI distributor, you must sync up the ignition timing with the ECU. You must have a timing light to perform this. You will possibly need a dial-back timing light or a harmonic balancer that is degreed up to 40 degrees. Again, open the Sensors monitor screen. You will see the “Ign Timing” parameter which will display what the commanded ignition timing is. Rev the engine up (CAREFULLY) to approximately 2000 RPM. Note the timing value on the handheld. Using the timing light, turn the distributor until the timing you see with the timing light matches what is on the handheld. Once synced, tighten down the distributor. From this point on, do not turn the distributor. The timing on the handheld should always match the timing on the distributor.

IMPORTANT NOTE: The timing at idle (TPS = 0) might be seen to be rapidly fluctuating. This is due to the ECU using the ignition timing to stabilize the idle. This is normal. This is why you need to check and sync the timing around 2000 RPM.

12.0 AFTER-STARTUP

Once the vehicle has started, look for any fuel or coolant leaks. Let the vehicle warm up and look at some other parameters to make everything is operating properly. Go into the MONITOR, MONITORS, and select the “Closed Loop” icon.

- **Closed Loop Status** – Indicates whether the engine is “Closed Loop” or “Open Loop”. Closed Loop indicates that the ECU is adding or subtracting fuel to maintain the target air/fuel ratio. The AVENGER™ calibrations are such that the system should be operating closed loop almost all of the time.
- **Closed Loop Compensation** – This is the percentage of fuel that the ECU is adding or subtracting to maintain the target air/fuel ratio at any specific moment. A value with a minus (-) sign in front indicates the ECU is removing fuel. A value with no minus sign indicates the ECU is adding fuel. When in open loop operation, this will always stay at 0%.
- **Target Air/Fuel Ratio** – This is the target AFR (air/fuel ratio) the ECU is trying to maintain. This will vary depending on the engine speed and load.

- **Air/Fuel Ratio Left** – This will show the air/fuel ratio the wideband oxygen sensor is reading. The Closed Loop Compensation should be adding or subtracting fuel all the time such that the AFR Left should always be close to the Target AFR value. (Note AFR Right will only be active if a second sensor is being used which is not included).
- **Fuel Learn Status** – This indicates the status of the AVENGER™ “Self Tuning” operation (Learn Status). The system will automatically tune itself as you drive around. There are several conditions that must occur in order for the Self Tuning to occur. The engine temperature must exceed 160° F. The system must be operating in a closed loop mode, and the Self Tuning must be enabled. The base AVENGER™ setups have the Self Tuning enabled. Once the engine reaches 160° F, the Self Tuning should be active. The Learn Stat will show “NoLearn” when Self Tuning is not active and “Learn” if Self-tuning is active.

If any of these parameters are not showing a proper value, find out why before further driving the vehicle.

13.0 IDLE SETTING/THROTTLE PLATE SETTING

Once the engine is up to operating temperature, the idle speed can be set to what is desired.

From the HOME SCREEN, select the TUNING tab. Then select the BASIC and then BASIC IDLE. You can see what the target hot idle speed is set to (**Figure 13**). If you are happy with the current value, use the BACK or HOME button to exit. If you would like to change it, click on the IDLE SPEED. This brings up a screen to adjust the idle speed. Move the button left and right to adjust it. Click the button to save the new value or select CANCEL at the bottom to move out of this screen.

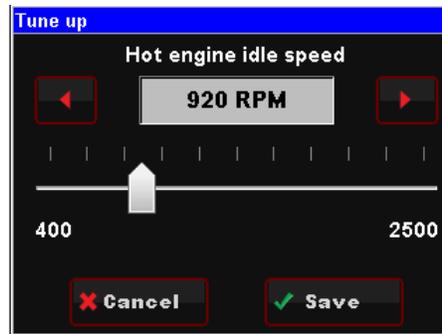


Figure 13

Whether you change the target idle or not, you need to set the throttle plates on the throttle body to an optimal position. To do so, with the engine running select the MONITOR tab. You will see the IDLE screen. Look at the “IAC Position” value. This value should be set between 2 and 10 with the engine in neutral and up to operating temperature. Also make sure the “TPS” value is showing a value of 0. If it is not, you need to perform a TPS AUTOSET.

If the “IAC Position” value is showing zero, you must close the throttle plates until it reads a value of 2-10. Slowly turn the throttle shaft adjustment screw on the throttle body out (counter-clockwise). If the IAC position is “stuck” at 0, it is likely that the engine is idling at a higher speed than you have set the target idle speed for. You need to adjust the throttle plates to resolve this issue.

If the “IAC Position” value is greater than 10, it is a good idea to open (turn the throttle shaft adjustment screw in, clockwise) the throttle plates until the “IAC Position” value is between 2 and 10. Note that if you open the throttle plates such that the “TPS” position goes above a value of 0, you will need to shut the vehicle off and perform a TPS AUTOSET. Then restart the vehicle and continue adjusting the throttle plates. Once the TPS goes above a value of 0, the ECU goes out of its “idle” mode and will lock the IAC Position to a fixed value.

When the adjustments are completed, make sure the TPS reads a value of 0 with the engine idling.

14.0 SELF-TUNING

At this point, it is time to just drive the vehicle and let the system perform its self-tuning process. The best way for this is to drive the vehicle under as many different operating conditions as possible. Different engine speeds and loads. Start by slowly revving the engine up in neutral and holding it at different speeds up to 2500 RPM. This will help the system learn these points. Then drive the vehicle, possibly using different transmission gears to learn in different areas. If you have an automatic transmission you may want to put it in gear, and with your foot on the brake pedal, apply a SMALL amount of throttle so that the system learns in this area as well.

NOTE: There are several conditions where Learning will NOT occur. They are the following:

- If the engine is below 160° F
- When the engine sees quick accelerator pedal movement
- Certain times when the accelerator pedal is lifted and the vehicle is coasting
- If the learn is disabled by the user

If you are interested in seeing if Self Tuning is completed in a certain area, you can look at the following:

- Select MONITORS from the HOME SCREEN
- Select the LEARN icon
- The FUEL LEARN STATUS indicates if the learn feature is active. The FUEL LEARN PERCENT indicates what the learn value is.
- Look at the CLOSED LOOP COMPENSATION value. Once this value is close to zero, learning is complete in an area.

At this point you can drive and enjoy your AVENGER™ EFI as it is. Sections 15.0 – 16.0 describe how you can adjust various parameters to further optimize fuel economy and overall performance, if desired.

15.0 BASIC TUNING

The AVENGER™ systems allow the user to perform some basic tuning changes to help optimize mileage, drivability, and performance. The tuning is split up into “Basic Tuning” and “Advanced Tuning” (Figure 14). The Basic Tuning allows changes to the Air/Fuel Ratio's the engine runs at and changes to Ignition Timing if a GM HEI or Ford TFI is used. The Advanced Tuning is typically not needed, but allows changes to some items that are less commonly used, or require some careful understanding before changing.

From the HOME SCREEN, select TUNING, and BASIC. There are six areas you can modify, BASIC FUEL, FUEL LEARN, BASIC IDLE, & SPARK (DRIVE BY WIRE and TRANSMISSION will not be used with this installation). These are reviewed below.

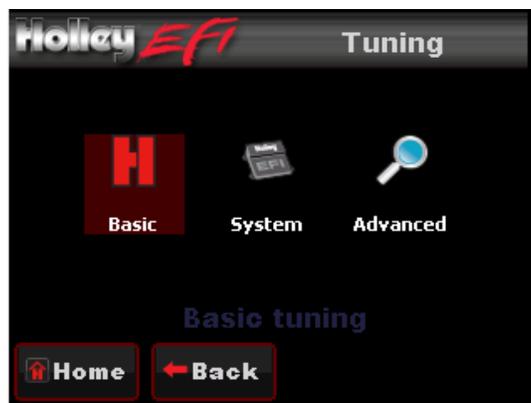


Figure 14

15.1 Basic Fuel

Selecting BASIC FUEL brings up the following menu (Figure 15):



Figure 15

15.1.1 Target AFR

Allows changes to the Target Air/Fuel ratio at idle, cruise, and wide open throttle (Figure 16). The following are typical values and some tuning notes.



Figure 16

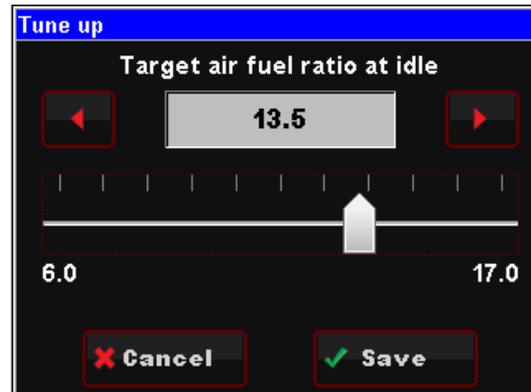


Figure 17

- **Idle Air/Fuel Ratio** – Typically between 13.5 and 15.0. Engines with larger cams may need a richer setting for smoothest idle.
- **Cruise Air/Fuel Ratio** – Typically between 13.5 and 15.5. Engines with larger cams may need a richer setting for smoothest operation.
- **Wide Open Throttle Air/Fuel Ratio (WOT)** – Typically between 12.0 and 13.0. Running richer may reduce power. Running leaner may reduce power or cause potential engine damage.

NOTE: The Target Air/Fuel setting between IDLE, CRUISE, and WOT is blended together automatically. Consequently, the air/fuel you see on the MONITOR screen, may not be exactly what you set for the settings. Changing these settings raises or lowers the “curve” of that specific area.

15.1.2 Acceleration Enrichment

Changes the “accelerator pump” function of the fuel injection. Raising the number increases the amount of fuel added when the pedal is pushed. Lowering the number decreases the amount of fuel added when the pedal is pushed. It is highly recommended NOT to change this until the ECU is allowed to perform self-tuning.

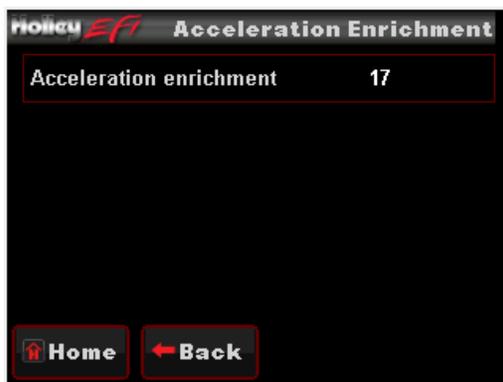


Figure 18

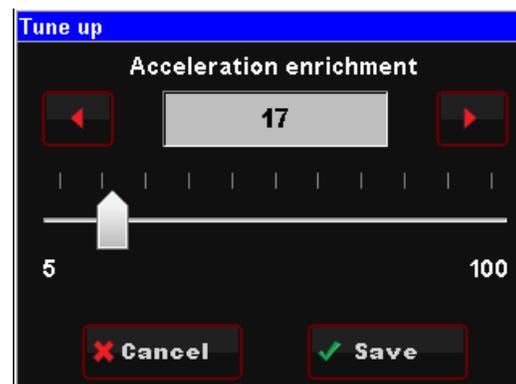


Figure 19

15.1.3 Fuel Prime

Fuel prime is an option that is enabled by default in all of the base calibrations. The fuel prime function injects a small shot of fuel into the intake manifold when the ignition is turned on, wetting the intake and allowing the engine to start much quicker. The amount of fuel is based on the engine temperature and how long it was since the engine previously ran. This amount of fuel can be increased or decreased by changing the “Percent” value. If the engine seems flooded reduce this value, if the engine seems to want more fuel, increase it. Experiment for best results. Typically this value will range from 75-150% with a maximum of 200% typically used.

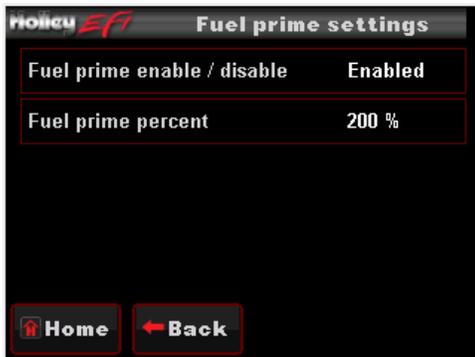


Figure 20

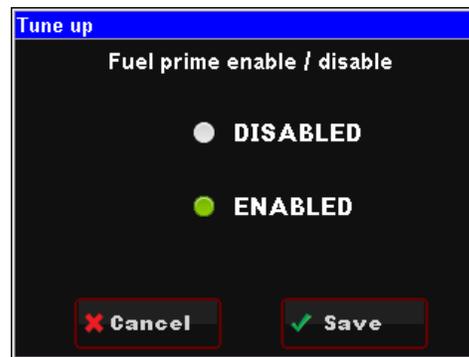


Figure 21

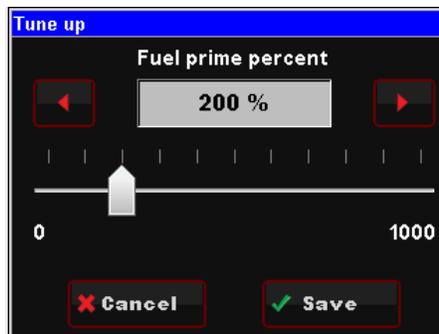


Figure 22

NOTE: This only injects fuel once at key-on, and will not do it again until the engine has run. This fuel prime occurs ½ of a second after key-on. If you quickly turn the ignition key without waiting for ½ a second, the prime will not occur and it may take longer for the engine to start.

15.2 Fuel Learn

15.2.1 Learn Enable/Disable

The LEARN Enable / Disable menu turns the Self Tuning “On” and “Off”. If enabled, self-tuning is performed. Learning should be enabled when an engine is just started and the tuning process is occurring. After the vehicle is driven under various operating conditions, and is running well, it is advised to disable learning, OR slow the Learn Speed to “Slow”.

15.2.2 Learn Speed

This parameter adjusts how fast the learning process occurs. In the beginning with a new tune it should be set to “Fast”. After the vehicle is driven under various operating conditions, and is running well, it is advised to disable learning, OR slow the Learn Speed to “Slow”.



Figure 23

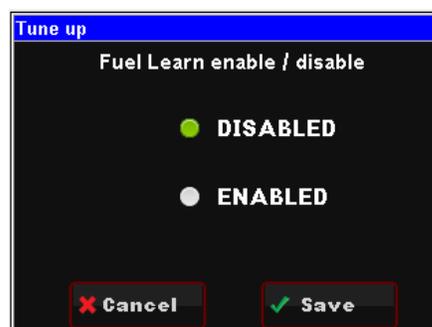


Figure 24

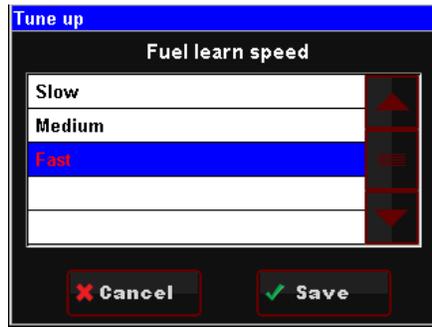


Figure 25

15.3 Basic Idle

Selecting BASIC IDLE allows you to change the Target Hot Engine Idle Speed. This should be adjusted to your desired idle RPM. Values between 650-800 rpm are typical. Larger camshafts or aftermarket torque converters may require a slightly higher value to maintain proper idle quality while in gear.

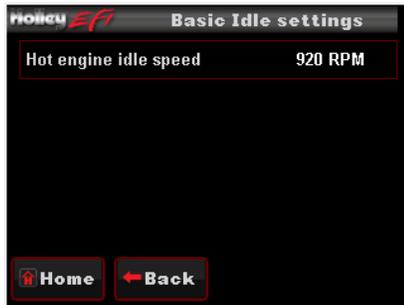


Figure 26

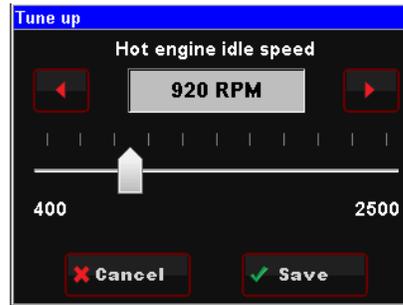


Figure 27

Selecting IDLE allows you to change the Target Idle Speed.

IDLE SPEED: Adjust the idle speed to what is desired.

15.4 Spark



Figure 28

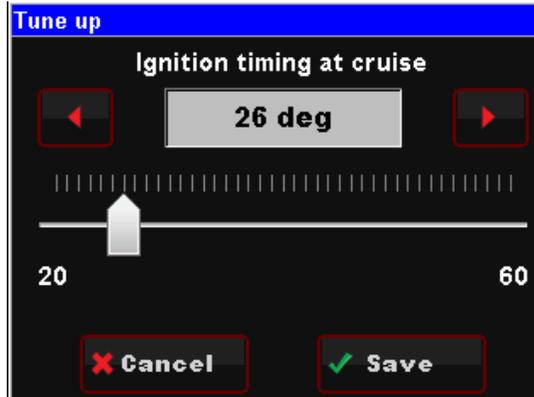


Figure 29

All Holley base tunes contain timing curves that will provide adequate engine operation, however the ignition timing at idle, cruise, and wide open throttle can be adjusted independently from each other to compensate for different engine combinations and geographical and climate extremes.

The following are typical values for each:

- **Idle Timing** – 18-34 degrees is typically used at idle. The larger the camshaft, the more timing is usually used.
- **Cruise Timing** – 32-48 degrees is typically used when cruising for optimal fuel economy.
- **Wide Open Throttle Timing (WOT)** – LSx applications typically don't use more than 28 degrees at WOT. Older V8 engines are usually between 32-38 degrees.

NOTE: Too much timing can cause pre-ignition that can damage an engine. Be cautious when tuning.

NOTE: The actual timing between IDLE, CRUISE, and WOT is blended together automatically. Consequently, the timing you see on the MONITOR screen, may not be exactly what you set for these settings. Changing these settings raises or lowers the “curve” of that specific area.

16.0 SYSTEM SETUP

16.1 System Tuning

From the HOME MENU, select TUNING, and SYSTEM. There are four areas you can modify; OUTPUTS, ENGINE SETUP, and IGNITION SETUP (Figure 30). **NOTE:** TRANSMISSION is not applicable for this installation.



Figure 30

16.1.1 Outputs

The OUTPUT screen allows for the Fan #1 and Fan #2 ON and OFF temperatures to be adjusted (Figure 31). The ON temp needs to always be a higher value than the OFF temp. Use a difference of at least 5 degrees so they aren't cycling excessively. In Avenger Kits these are ground outputs that should be wired to trigger the fan relays. NEVER wire them directly to the fans! The AC Disable value is a TPS value above which a 12 volt output is sent out to deactivate the air conditioning compressor at wide open throttle (Figure 33).

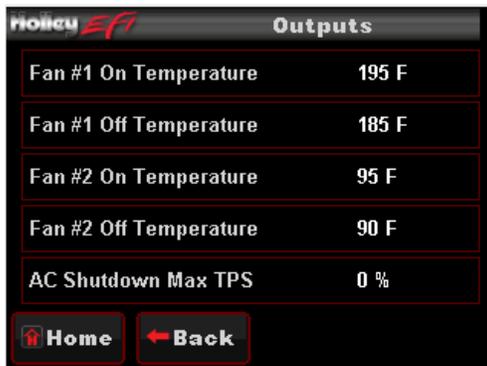


Figure 31

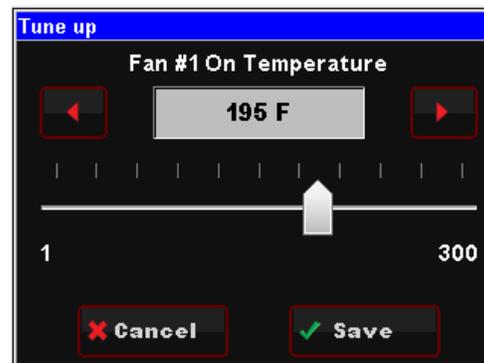


Figure 32

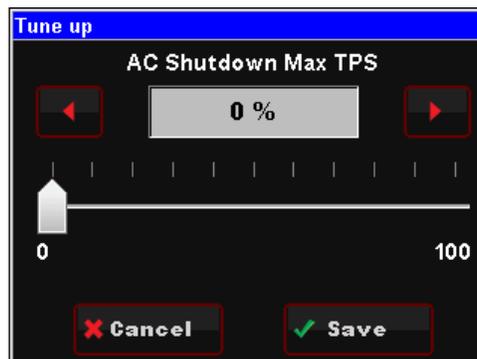


Figure 33

16.1.2 Ignition Setup

There are two parameters that are adjustable in the IGNITION SETUP. Ignition input type and engine rev limiter.

REV LIMIT – The rev limiter is only enabled when using a computer controlled small cap GM HEI. It is an ignition-only rev limiter. It will not shut fuel off. Enter a value for which you'd like the rev limiter to start.

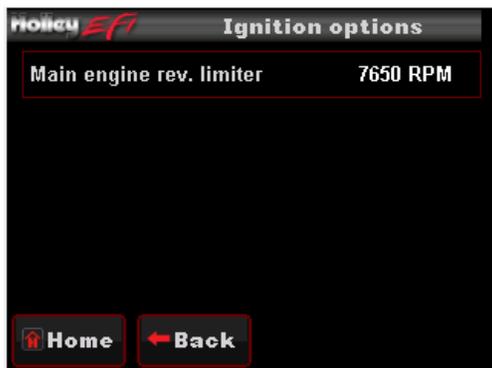


Figure 34

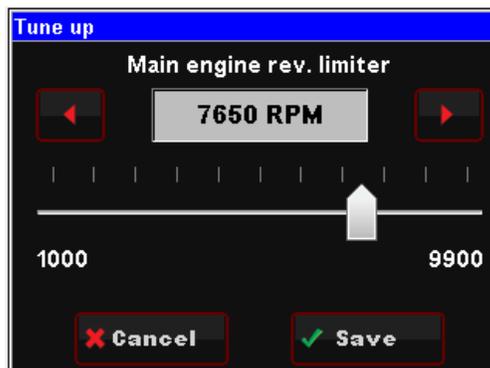


Figure 35

NOTE: AVENGER™ injector size/flow is calculated at 43 PSI.

FOR ADVANCED TUNING INFORMATION PLEASE GO TO http://documents.holley.com/techlibrary_199r10751.pdf

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