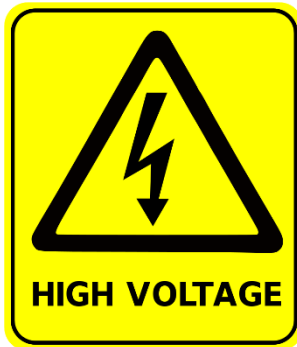


## WARNING: HIGH VOLTAGE!



### DISCONNECT THE BATTERY BEFORE INSTALLING OR SERVICING ANY IGNITION SYSTEMS COMPONENTS.

Failure to follow these instructions and the vehicle owners' handbook and shop manual could result in serious personal injury, death and or damage to property. This part is designed to be installed by a mechanic that is familiar with European automobiles and safety standards.

#### Caution

The programmable function of this ignition module is intended for off road motor sport use only. Perma-Tune makes no warranties, whether written or oral, expressed or implied. Perma-Tune specifically disclaims implied warranties of merchantability and fitness for a particular purpose and disclaims any liability from accident, misuse or damage to property as a result of using this ignition system.

These instructions will show you how to connect your Perma-Tune ignition module to any USB equipped tablet or laptop using Perma-Tune Advanced Ignition Technology®. If you need help installing this software on your computer, factory technicians may be able to help by connecting to your computer remotely. Contact us for more information.

### Features of the Gen 5, PA15 Firmware Perma-Tune Ignition

Perma-Tune allows you to control engine ignition system functions with a single module, wirelessly, eliminating multiple modules and yards of wiring. Here is a partial listing of the functions available with the PA15\_328 version firmware currently in use.

- A. Period correct appearance enhances the car.
- B. Works with any distributor.
- C. Signal smoothing stabilizes ignition timing.
- D. Soft RPM limit is adjustable and suitable for driver training.
- E. User defined multiple spark settings for easy starts.
- F. Programmable built in RPM switch for shift light adjustments.
- G. Advance curve settings have 16 positions for smooth advance timing.
- H. Advance switch function for vacuum advance and other uses.
- I. Self-diagnostics indicators can be read at a glance.
- J. Can be programmed as a standalone device using any USB port or as a mobile device using any smart phone.

There are two ways to do the programming depending on your needs: as a standalone part connected to your desktop or as a mobile device.

The 90502 USB smart wire allows the standalone programming of your Perma-Tune connected to a USB port. The smart wire connects the desktop computer to the Perma-Tune and powers up the Perma-Tune for programming purposes, no other connections are needed. Use this part for saving



copies of the program for future reference and for setting things that will not need to be changed often. Most of the time this part is used by the engine builder to set and record the programs and can be used on any Perma-Tune part number that ends in the suffix "903".

The 90506 Bluetooth smart wire is for programming the Perma-Tune as a mobile device. This part is plugged into the Perma-Tune at installation and is left in the car. The wire that connects the Perma-Tune to the Bluetooth antenna module is intended to look like a ground wire so the Bluetooth antenna part of the smart wire can be hidden somewhere. The engine lid is a good spot. Use this part when you need to make quick changes using your smart phone or tablet. You can then save the program on your tablet for future reference or use the 90502 part to save the program on your desktop computer.

## **Perma-Tune to USB Connection**

### **Introduction**

The Gen 5 Perma-Tune, when paired to the 90502 Plug, is compatible with any PC running Windows XP, Windows Vista or Windows 7 and 10 operating systems. The 90502 Plug can be used with any USB 3.0 or higher equipped device. It is not compatible with MAC computers. For Mac and I Phone devices, use the 90504 USB Plug. Any terminal emulation application that is designed to work with USB can be used to program your Perma-Tune and is designed to use open source RS232 communications protocol.

When using a laptop or tablet computer, the Perma-Tune can be programmed while it is bolted into the car provided that the Perma-Tune is unplugged from the car harness. It is very important that you unplug the device from its AC charger before connecting to the Gen 5 Perma-Tune. The laptop must be operating on battery power alone or communications problems can occur while data is being transmitted to the car.

When using a desktop computer, the Perma-Tune must be unplugged from the car for programming purposes. The green power indicator will flash when the Plug is correctly connected and the USB device is providing programming power.

### **USB to Perma-Tune Set Up**

1. Plug the 90502 into the computer USB port. DO NOT plug the wire into the Perma-Tune yet. DO NOT open Hyper Terminal yet. The computer will automatically go onto the internet, download the driver software and install it. Open the installation window during this process and note the COM port that has been assigned to the 90502. You will need this information later. If your computer does not display the COM port assigned to the 90502, it can be selected later in step 6. If your computer did install the drivers automatically, skip to step 3, otherwise proceed to step 2.
2. If your computer did not load the drivers for the USB wire, follow these instructions:
  - a. Plug the 980502 into your computer USB port.
  - b. Open the Control Panel, then open Hardware and Sound.
  - c. Under Devices and Printers, open Device Manager.
  - d. Expand the Universal Serial Bus controllers and then open USB Serial Converter.
  - e. Open the Driver tab and then open Update Driver.
  - f. If you have internet access, then search for a driver using that option. If you have a USB Flash drive from Perma-Tune, browse to the "Drivers" folder on that flash drive.
  - g. Install the driver by clicking on it.

Note: Do not open Hyper Terminal yet. If Hyper Terminal was already open when you plugged in the 90502 to the USB port, close Hyper Terminal and then unplug the 90502 from your USB port. Plug the 90502 back into your computer and then let the computer discover the 90502 again. If your computer does not



automatically discover the 90502 and install the drivers for the USB plug, download a generic USB Serial Converter driver from the Microsoft web site. See step 2.

3. Open Hyper Terminal on your computer, it should be in your Accessories program file. If your computer is not already equipped with Hyper Terminal, you can download it for free from:

<http://www.hilgraeve.com/hyperterminal-trial/>

4. The first time you open Hyper Terminal you will be asked to set up the phone connection. You need only enter your Country/region and Area code. You will not be asked this again. Selecting the Country/region will determine in which language Hyper Terminal will display.
5. From the File menu, select New Connection. Give the connection a name like Perma-Tune COM X that you noted in step 1. If you cannot find the COM port, then the drivers are not installed. In this case refer to step 2.
6. Under the Connect using drop down menu, select the COM port that you noted in step 1. Then click OK. If you do not know the COM port assigned to the 90502, select one from the drop down menu. You cannot proceed from this step until the correct COM port has been selected.
7. The Port Settings page will appear. Check the default settings and click OK. The defaults should be 9600 Bits per second, 8 data bits, no parity, one stop bit and no flow control. If you have to change any default settings the Hyper Terminal must be restarted before trying to program your Perma-Tune. Save the connection before restarting Hyper Terminal.
8. Unplug the Perma-Tune from the vehicle. Do not plug it back in until the programming session is complete.
9. Plug the 90502 into the Perma-Tune "Bluetooth" connector. The green power indicator on the Perma-Tune should begin flashing and remain flashing during the programming session. The red fire indicator should never flash during the programming session.
10. You will now see the communications window. Note that the Call icon is highlighted, if it is not highlighted, Click the Call menu and then click Call. You are now ready to begin programming your Perma-Tune. You will know that the connection is good when you see "? for help>" appear in the programming window upon pressing the enter key.
11. When you are done programming the Perma-Tune, click on the Disconnect icon and save the connection for future use.

## Programming Instructions

### Introduction

Refer to the program settings that came with your Perma-Tune: the settings in the instructions below are for demonstration only and may not be the correct settings for your vehicle. The data input attention time of the terminal is only about two seconds per character. This requires that you enter your commands quickly and accurately. It is best to copy the terminal screen settings of your Perma-Tune before and after making changes. You may want to accumulate a library of programs tailored for your engine. After making your selection press the Enter key on the keyboard to store your changes.

How to program your Perma-Tune using Hyper Terminal

### Help Menu

Press the Enter key on your computer. You should now see this on the Hyper Terminal programming window: **? for help>**

Type in the ? mark and then press Enter. You should now see the left side of the chart in the Hyper

Terminal programming window:



Programming Window	Function
? for help>?	Input prompt: Type in your command after the >.
2: Set 2S RPM	RPM at which the double strike will revert to single.
3: Set 3S RPM	RPM at which the triple strike will revert to double.
A: Set adv. point	Advance curve settings in crankshaft degrees.
D: Settings	Displays all current settings.
F: Set F-delay	Signal smoothing.
I: Set type Elec=0, Mech=1	Magnetic pulse or points input setting.
L: Set RPM Switch	RPM at which the switch will activate.
R: Set max RPM	Soft RPM limiter setting.
T: Set Transition type Neg=0, Pos=1	Triggering on the positive or negative going signal.
V: Set Advance Switch	Enables or disables the advance switch function.

## Using the Functions

After entering the function code, press the enter key on the computer. More information about the function will appear in the programming window. The commands must be entered quickly or the input prompt will appear which will then require you to reenter the command.

**CAUTION:** After entering each command line, press the **Enter** key or your changes will not be stored. At the end of a programming session, the ignition key must be cycled off and on again for the changes made during the programming session to become permanently stored in the Perma-Tune memory. Before restarting the engine, always verify your settings by using the display **D** command.

**Note: All communications functions are automatically locked out when the engine is running.**

? = Displays the single digit codes for accessing the programmable functions.

2 = Sets the double strike function, this will appear in the window: **2: Set 2S RPM**

Enter a number and press return. When this function is used, the Perma-Tune will produce a spark on command from the distributor and then another within 2.5 mS after the first spark. This will occur from zero RPM to whatever RPM is entered into this function. **Caution: In general, this setting should be just below the normal, warm idle RPM. The maximum setting is 500 RPM. Note: The 2 strike setting must always be higher than the 3 strike setting or the Perma-Tune will ignore the trigger signal.**

3 = Sets the triple strike function, this will appear in the window: **3: Set 3S RPM**

When this function is used, the Perma-Tune will produce a spark on command from the distributor and then two more within 2.5 mS of each other after the first spark. This will occur from zero RPM to whatever RPM is entered into this function. In the case of overlapping 2 and 3 strike functions, the three strike function is dominate. **Caution: In general, this setting should be just above the normal cranking RPM produced by the starter. The maximum setting is 250 RPM Note: The 3 strike setting must always be lower than the 2 strike setting or the Perma-Tune will ignore the trigger signal.**

A = Sets the RPM versus degrees of crankshaft advance, this will appear in the window: **Enter point:**

Enter a number between 0 and 15. Entering zero will set the advance point between zero and 499 RPM. Entering one will set the advance point between 500 and 999 RPM. Entering two will set the advance point between 1000 and 1499 RPM and so on up to 8000 RPM. After entering a number, this will appear in the window: **Enter Advance (Deg) :** Enter a number between zero and 30. Repeat the process until all points are entered. **Caution: If this function is not used, all advance settings must be set to 30 degrees. To use this function, the distributor must be mechanically locked to the 30 degree position.**

D = Displays the current program settings, these settings will be different for the type of engine your Perma-Tune is installed in. For illustration, here are the pre-set program settings for the 911SC903 Perma-Tune that should appear in the window for the stock, 2.7 L Porsche 911SC engine:

## -----Settings-----

Ver : PA15\_328  
Serial# : XXXXXXXX  
Type : Elec  
Transition : NEG  
F-delay : 400 us  
PW : 1100 us  
#Cyl : 6  
Max RPM : 8000 RPM  
2S RPM : 300RPM  
3S RPM : 150 RPM  
RPM switch : 7000 RPM  
Advance switch : Disabled  
Advance curve:  
RPM 0, ADV 30  
RPM 500, ADV 30  
RPM 1000, ADV 30  
RPM 1500, ADV 30  
RPM 2000, ADV 30  
RPM 2500, ADV 30  
RPM 3000, ADV 30  
RPM 3500, ADV 30  
RPM 4000, ADV 30  
RPM 4500, ADV 30  
RPM 5000, ADV 30  
RPM 5500, ADV 30  
RPM 6000, ADV 30  
RPM 6500, ADV 30  
RPM 7000, ADV 30  
RPM 7500, ADV 30

F = Sets the mechanical points de bounce delay, this will appear in the window: **F: Set F-delay**

Points bounce occurs at high RPM with mechanical points when the points bounce back open for an instant after closing. This condition causes the ignition timing to become unstable at high RPM. It can be compensated for by using the Perma-Tune controller to ignore any rising signal resulting from points bounce for a pre determined amount of time after the points close. This setting determines how long the Perma-Tune controller will wait after the points close before it will accept the signal from the points opening. In most cases, 500 uS will allow plenty of time for the signal to stabilize before the points open. If the distributor points dwell time is very low, then this time may be too long and the controller may ignore the points opening signal. To remedy this, reduce the de bounce time. When the Elec triggering is selected, this setting is used to eliminate false triggering that may occur during the negative to positive transition of the triggering signal.

I = This setting determines the type of triggering being used, this will appear in the window: **I: Set type Elec=0, Mech=1**

Elec means electronic distributor like the 911SC, Mech means breaker points like the 356 and 911. The triggering circuitry for the electronic distributor is automatically set for zero crossing triggering. For the 911SC903 Perma-Tune, this must always be set to 0. For the 911903 Perma-Tune this must always be set to 1. **Note: The Perma-Tune controller will ignore the trigger signal if it is set wrong for your Perma-Tune and so will not function.**

R = Sets the maximum RPM limit, this will appear in the window: **R: Set max RPM**

You may enter any number between 6,000 and 10,000 RPM. When the engine reaches the RPM set here, the Perma-Tune controller will begin to randomly drop ignition pulses, thus causing the RPM limit to be "soft" rather than just shutting off the ignition pules. If the RPM exceeds the limit, (as can happen with a missed shift) then the controller will increase the number of dropped ignition pulses. If the RPM continues to increase above the pre set limit, at 3% above that limit the Perma-Tune controller will shut off the ignition pulses completely. **Caution: the correct cylinder number must be programmed into the Perma-Tune or the RPM limit may be higher than expected and could result in severe engine damage.**

T= Sets the triggering on the negative or positive going of the distributor signal. This will appear in the window: **T: Set Transition type Neg=0, POS=1**

Entering 0 will cause the triggering to occur on the negative going signal and 1 will cause the triggering to occur on the positive going signal. For the 911SC903 Perma-Tune this setting should always be set to 0. For the 911903 Perma-Tune this should always be set to 1. **Note: Setting this to the wrong setting for your Perma-Tune will cause the ignition timing to be off by about 30 degrees.**

V = Enables or disables the vacuum advance function this will appear in the window: **V: Set Advance switch 0 = disable 1 = enable**

The default setting is **disabled**. The **enabled** setting is only used in conjunction with the timing curve function. When the advance switch sensor wire is grounded, the timing will automatically adjust to 30 degrees advance regardless of engine RPM. This function is usually used to replace mechanical vacuum advance mechanisms in the distributor. It can also be used for other functions that require the timing to be advanced.

### Adjusting the ignition timing curve:

Ignition timing is a delicate balancing act so always start with the timing you used the last time the engine was raced. Keep in mind that the Perma-Tune system cannot advance the ignition timing, it can only delay the timing. The programmable maximum setting is 30 Degrees of crankshaft rotation at any given crankshaft RPM between 1 and 10,000 RPM. Therefore, the program representation of A=0 indicates 30 Degrees of delay time and A=30 indicates no delay time. There are sixteen fixed timing settings, designated A0 thru A15, available between zero and 7,500 RPM at 500 RPM intervals.

### Distributors without mechanical timing advance:

Most twin plug racing distributors have no mechanical advance mechanism. The ignition system trigger signal is synchronized to the alignment between the distributor cap and the distributor rotor by virtue of design. This synchronization, or "phasing" between the cap and rotor poles at the instant of ignition is critical to engine performance. On the Porsche 911 3.0L engine, the optimum setting is conveniently marked on the crankshaft pulley at 30 Deg. BTDC.

Assuming your distributor is locked down to 30 Degrees BTDC crankshaft, then the setting of A=30 means that the ignition system adds no delay time to the distributor timing. As soon as the trigger signal comes in from the distributor the ignition will make a spark exactly at that time. This is your maximum timing advance setting. If you want your timing to be zero degrees BTDC for cranking, then setting A=0 will set the timing to TDC for zero thru 499 RPM. To program 10 Degrees for idle, set A=10 for 10 Degrees BTDC from 500 to 999 RPM.

To test your settings, use a timing light to view the engine timing marks. The setting A=0 should show TDC on the timing pulley marks. Revving the engine should show 30 Degrees on the timing pulley marks. The distributor cap and rotor poles should align at 30 Degrees.

### Distributors with mechanical timing advance:

Mechanical advance mechanisms can be vacuum operated or centrifugally operated. Most street car engines have both, most single plug race car engines have only centrifugal timing advance. To use only the mechanical advance settings, set all 16 advance indicators to A=30 and the Vacuum Adv. to Disabled. These are the default factory settings.

### How to fine tune the existing mechanical timing curve:

The timing can be controlled via the Bluetooth link to fine tune the engine for performance or driver training. Using the mechanical timing mechanism to provide the basic timing curve keeps the cap and rotor phasing correct at any RPM. Connect a timing light to the engine. Note the current timing settings. Adjust all Perma-Tune settings to A=25 and read the timing settings again. They should have moved 5 Degrees retarded. Rotate the distributor to reset the timing settings back to the original readings. As long as all the timing settings are A=25, the original mechanical timing settings have not changed on the engine. Altering the Perma-Tune settings between A=20 and A=30 will provide 5 Degrees of timing deviation from the original timing map. In this way you can safely advance or retard the ignition timing within a few degrees of the original timing map.

While adjusting the timing map, you may also want to add or remove multiple sparks, change RPM limit, change shift light RPM, or other functions.