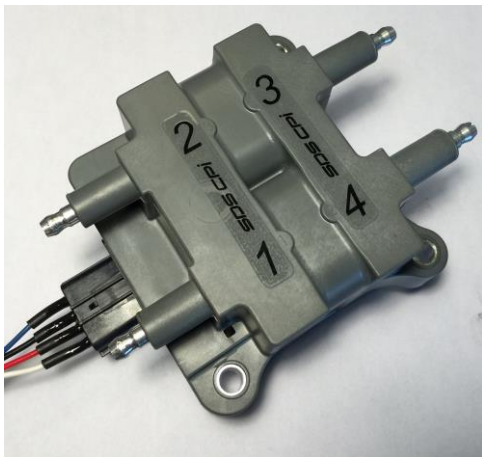


# CPI

## CoIL PACK IGNiTioN FOR AViATioN



Coil pack (4 cylinder)



Coil pack (6 cylinder)



**For 4,6 and 8 cylinder 4 stroke applications.  
Please read the entire manual before beginning installation.**

Software version 2.2 to 2.4 April 5/17.

## System Description

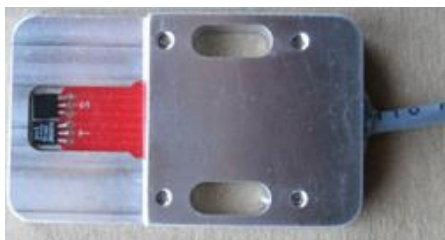
The CPi unit is a microprocessor based ignition unit designed to trigger the supplied waste-spark type coil packs. Engine spark timing is fully programmable for both RPM and load (manifold pressure or throttle position). Triggering is accomplished with magnets attached to the crankshaft and a Hall effect sensor fitted to the engine case. As such, timing variations relating to gear lash or harmonics are eliminated.

## Theory of Operation

A hall effect sensor is mounted near the crankshaft pulley sensing magnets mounted in the pulley. Two triggering magnets are used on 4 cylinder, three triggering magnets are used on 6 cylinder applications, 4 triggering magnets on an 8 cylinder. One sync magnet is also used to synchronize the computer with the engine so the computer knows which coil to fire first. As each magnet passes the Hall sensor, a pulse is sent to the CPi. The CPi determines the exact rpm and manifold pressure, sums the programmed spark retard values and calculates the appropriate delay for the specific conditions at that instant, then triggers each coil to fire at the precise time. Each coil fires two cylinders simultaneously, one cylinder on compression, the other on exhaust.

Once the system has been calibrated using a timing light by setting the MAG POS (MAGNET POSITION) value, the gauge mode will accurately display the actual ignition timing in degrees BTDC in real time. Programming can then be accomplished in the simplest possible terms to understand.

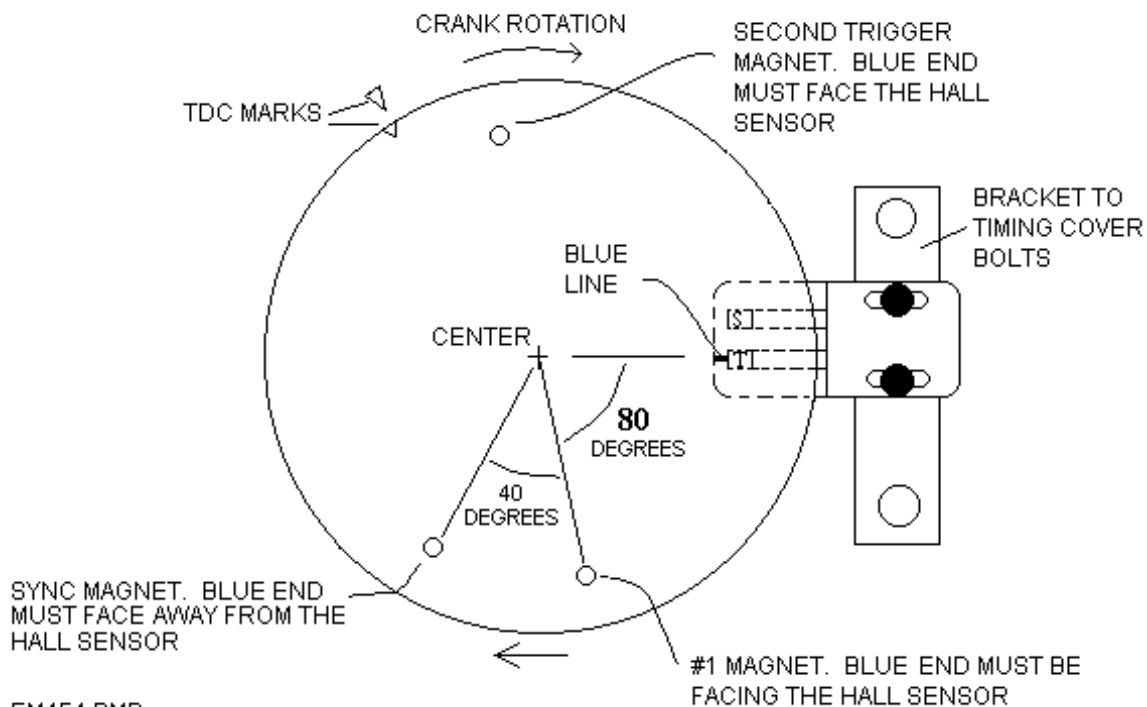
### Hall sensor (adjustable type)



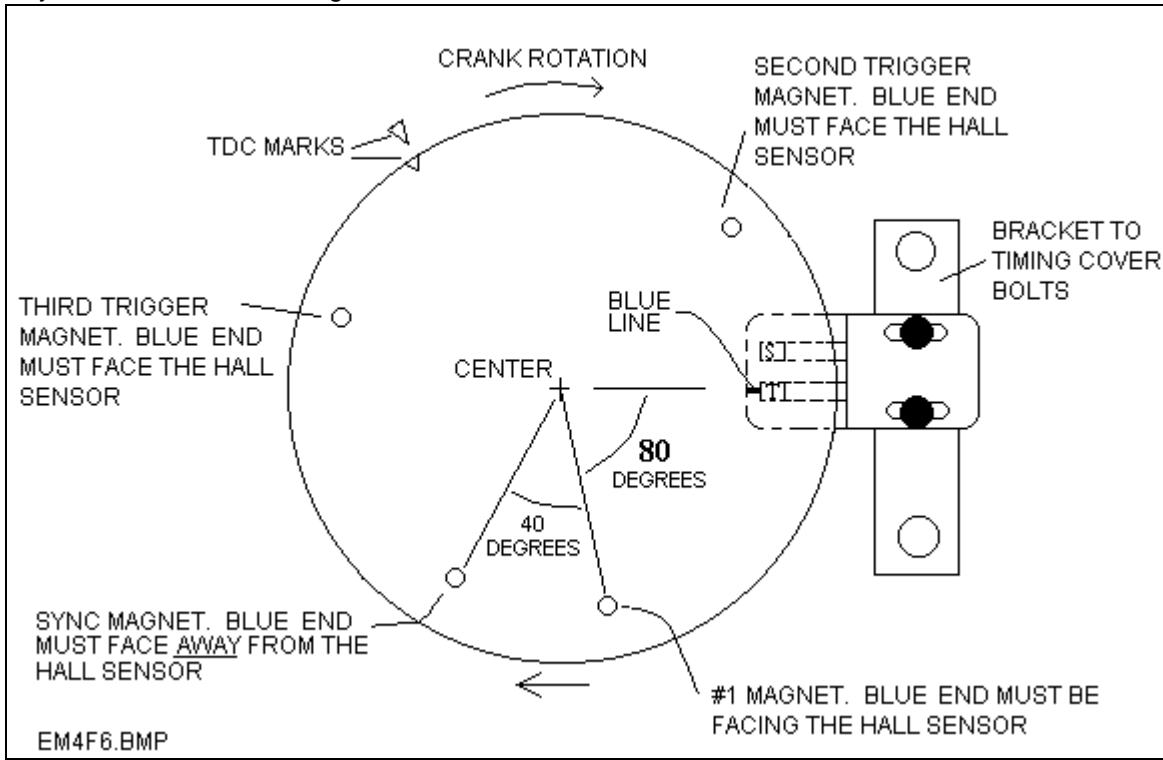
### Hall sensor (non-adjustable type)



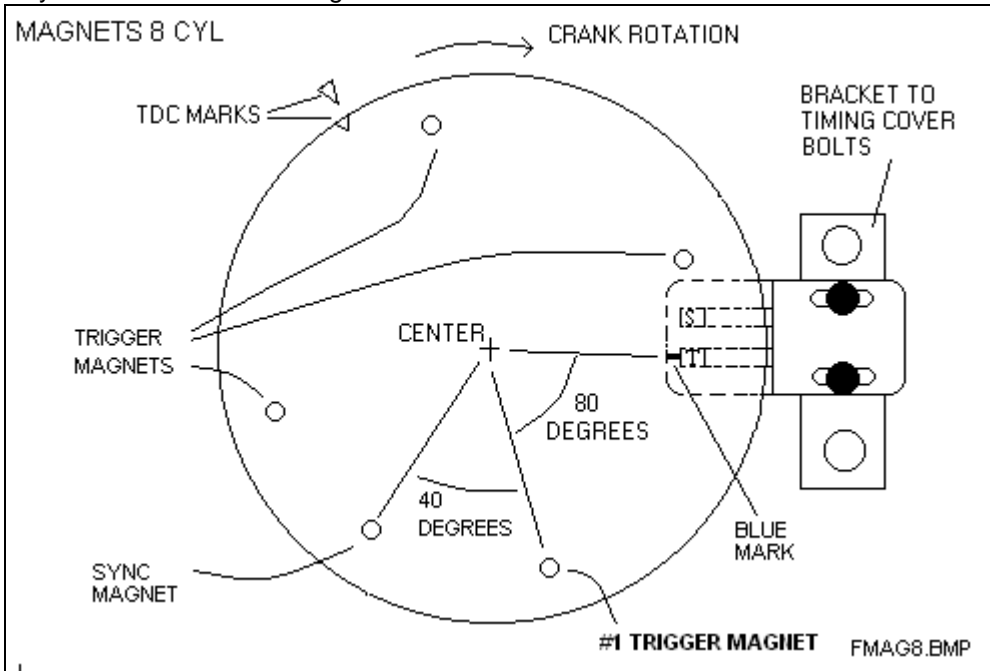
4 cylinder schematic drawing of hall sensor installation.



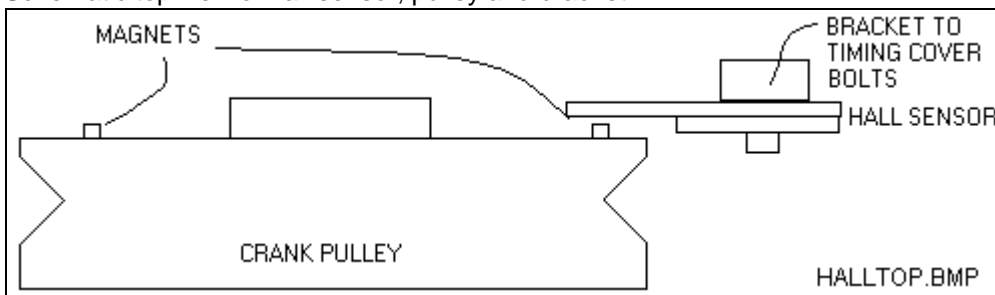
6 cylinder schematic drawing of hall sensor installation.



8 cylinder schematic drawing of hall sensor installation.

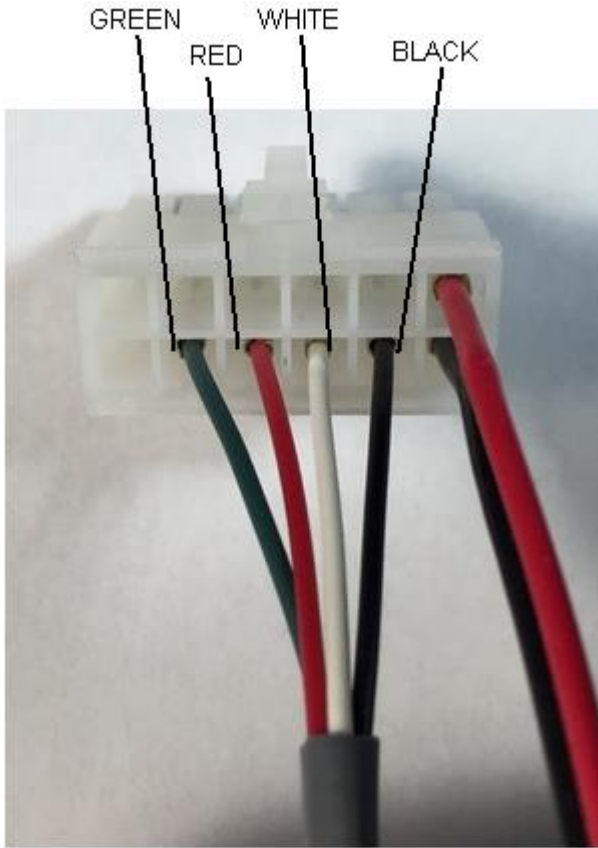


Schematic top view of hall sensor, pulley and bracket.



## Hall sensor cable & pins

Hall sensor wires plug into the CPI connector as shown here on the bottom 4 middle pins.  
Watch colors carefully.



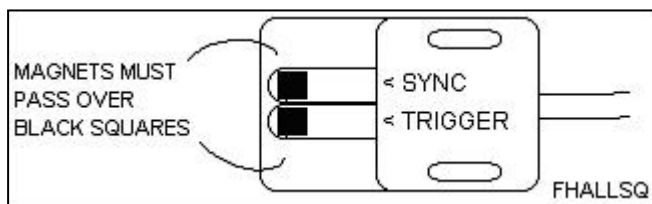
HALL SENSOR  
CABLE

## Aligning the Hall sensor and magnets

### MAGNET SEEN WINDOW



Top line is used for checking trigger magnets.  
Bottom line is used for checking the sync magnet.  
When in this screen, the Status LED will also light when a magnet is over the sensor, and when the engine is running the Status light may flicker in this screen as magnets pass the sensor.



**Important! Disconnect power to the coil pack to disable the spark while rotating the crankshaft.**

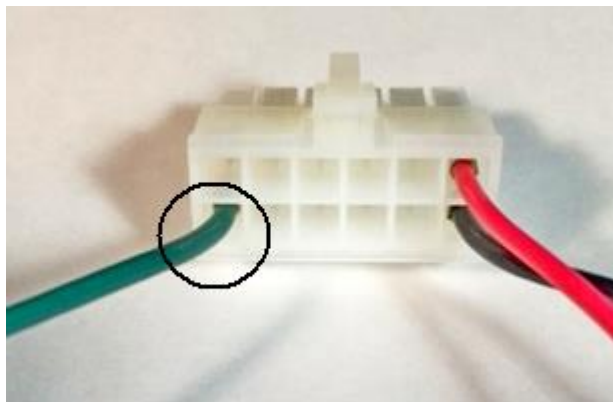
Steps:

1. Best to rotate the crankshaft so that a trigger magnet is closest to the sensor.
2. Have the mounting bolts loosened slightly and slide the sensor in or out until the window shows TRIG YES. YES means the CPI is seeing the trigger magnet.
3. On adjustable sensors, slide the sensor back and forth and try to find the mid-point where the Trig shows YES.
4. Tighten the hall sensor mounting bolts. Check remaining trigger magnets and also the sync magnet. Non-adjustable Hall sensors don't require any alignment procedures.

**Each magnet should be SEEN for at least 2 to 3 degrees of crank rotation.**

Note: This window has no use once the engine is running, since the sampling rate of the programmer is only about twice per second.

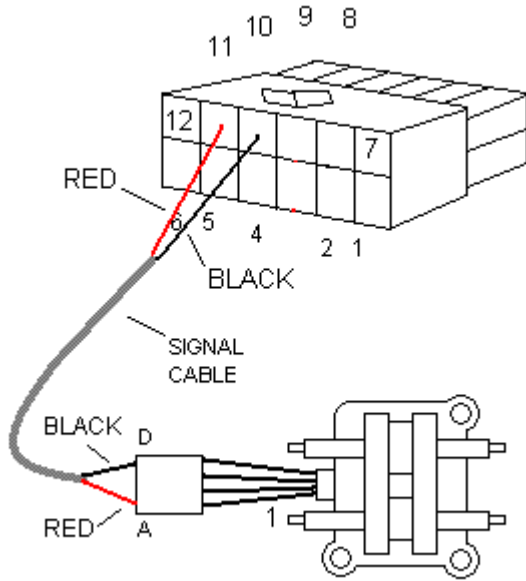
## Tach output, CPi power and ground wires



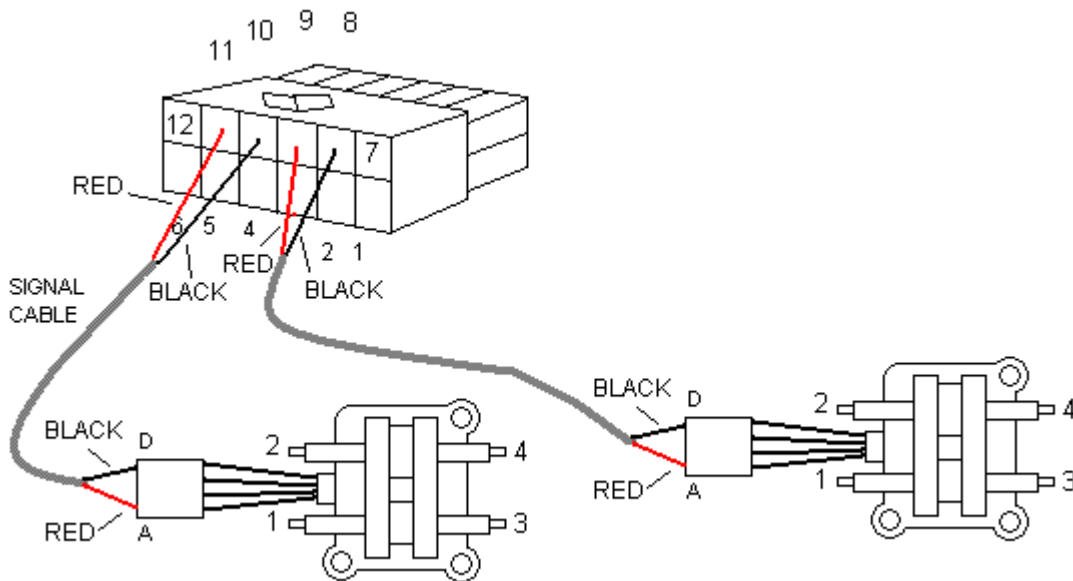
The Tach output wire (circled in photo) goes to the tachometer signal input.

Power, red wire in photo top right corner, goes to key switched fused 12 volts. Current draw is approximately 100mA or 0.1amps. A 1 or 3 amp fuse can be wired inline with the red wire if the power source has no fuse already. Black wire in photo bottom right corner, goes to a known good ground such as chassis or Battery negative.

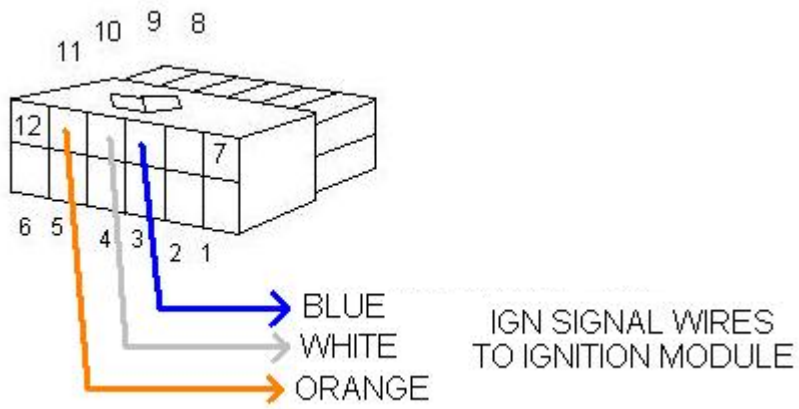
### CPI signal cable connections 4cyl



### CPI signal cable connections 4cyl Twin spark plug per cylinder

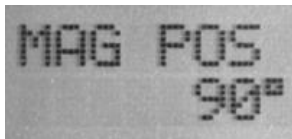


# CPI ignition signal cable connections 6cylinder



# PROGRAMMING THE CPI

## MAGNET POSITION



### Initial Setup - VERY IMPORTANT

This is how timing is calibrated. This step requires a timing light. The best timing light to use, is one that does not have a delay knob. Delay lights may not work properly with multi-spark ignitions or with multi-coil/waste spark ignitions. If you only have a delay type light set the delay to 0. The crank pulley and timing cover must have timing marks on them. The timing light inductive pickup clamp can also be connected onto the ground wire of the coil pack unit if clipping to the spark plug wires does not work well.

**This step should be performed as soon as the engine is fired up and idling. Ignition timing is meaningless without first setting the MAGNET POSITION parameter properly.**

A value of between 70 and 90 entered should allow the engine to be started. 80 would be a good starting point and is where the system is factory set. Use 90 on Lycoming engines.

STEP 1. Using the Programmer set the following parameters:

RPM IGNition 500 to a value of 10.  
 RPM IGNition 750 to a value of 10.  
 RPM IGNition 1000 to a value of 10.  
 RPM IGNition 1250 to a value of 10.  
 RPM IGNition 1500 to a value of 10.

If engine has a max rpm range of 4500, set RPM IGN 1100 thru 1500 to a value 10.

STEP 2. Make sure that all IGN RET-ADV/LOAD values below 30 inches are 0.

STEP 3. Start the engine and keep it running below 1500 rpm.

STEP 4. Connect a timing light.

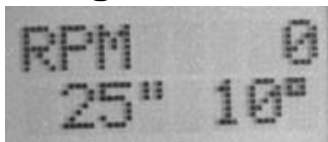
STEP 5. Change the MAGNET POSITION value until the timing light reads 10 degrees BTDC.

Once the MAGNET POSITION is set, it does not have to be changed again- it is only to tell the ECU what the "distance" between the #1 MAGNET and Hall sensor is. Once the above 5 steps are completed, you can program any of the ignition values.

MAGNET POSITION may need to be adjusted if the Hall sensor is removed for engine repairs, so after it is installed again, then the above procedure should be completed, so the ignition timing is the same as before.

If you find you need to exceed the limits of mag pos then this means the magnets are mounted in the wrong locations and will need to be redone. Limits are 60 and 100 for this value.

## Gauge Mode Screen



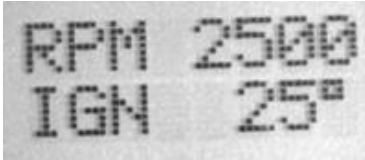
This screen is much like a dashboard, showing a live reading of engine RPM's, Manifold pressure (25 inches shown) and current amount of ignition timing on right side. Aircraft applications are in absolute inches mercury. Proper readings with a typical engine at idle should be around 8 to 12 inches with a prop installed.



# Ignition Programming

Ignition timing requirements differ widely between various types of engines and fuels used so we can only offer general guidelines for ignition values. **SERIOUS ENGINE DAMAGE CAN OCCUR with improper values entered.** Excessively retarded timing can cause high exhaust gas temperatures while advanced timing can lead to pre-ignition and detonation. **Default values may not be correct for your engine!**

## RPM IGNITION



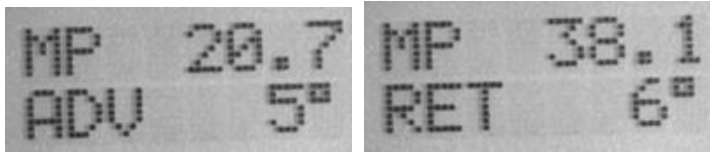
For example, if you want timing at 25 degrees BTDC at 2500 RPM go to RPM IGN 2500 and enter 25. Etc.

Most engines want total timing between 10 and 15 degrees BTDC at idle-. As RPM is increased, total timing is usually slowly increased up to around 1800 rpm where full rpm advance should be in. This figure is maintained right up to max rpm usually.

Here is a typical RPM only timing curve:

| RPM  | IGN |
|------|-----|
| 500  | 10  |
| 750  | 10  |
| 1000 | 10  |
| 1100 | 10  |
| 1200 | 12  |
| 1300 | 14  |
| 1400 | 16  |
| 1500 | 18  |
| 1600 | 20  |
| 1700 | 22  |
| 1800 | 24  |
| 1900 | 25  |
| 2000 | 25  |
| 2100 | 25  |
| 2200 | 25  |
| 2300 | 25  |
| 2400 | 25  |
| 2500 | 25  |
| 2600 | 25  |
| 2700 | 25  |
| 2800 | 25  |
| 2900 | 25  |
| 3000 | 25  |
| 3100 | 25  |
| 3200 | 25  |
| 3300 | 25  |
| 3400 | 25  |
| 3500 | 25  |
| 3600 | 25  |
| 3700 | 25  |
| 3800 | 25  |
| 3900 | 25  |
| 4000 | 25  |
| 4100 | 25  |
| 4200 | 25  |
| 4300 | 25  |
| 4400 | 25  |
| 4500 | 25  |

## MP ADV RET



Manifold Pressure Advance/Retard.

These 64 settings allow programming of ignition retard or advance with reference to load on the engine. Load information is from the MAP (MP) sensor. RET refers to retard, and ADV refers to advance.

ADVance adds to your timing, usually at lower MAP to help fuel economy (left photo above).

RETard reduces timing, usually done at higher MAP to prevent detonation (right photo above).

ADVance will be added to RPM IGN, RETard will get subtracted from RPM IGN.

If too much retard is programmed, power output from the engine may be reduced significantly.

Advance may be useful to improve fuel economy. Advance can be programmed by pushing the -1 button.

Below are some example values for timing. Some advance is used under low MAP to help fuel economy, and some retard at high MAP to help prevent detonation. The total timing column does not show all possible results. For instance the engine could be running at 2500 RPM with 28.9 inches MAP, so in this case, the total timing would be  $25 - 4 = 21$  degrees.

| RPM  | Value | MAP  | Value | Ret/Adv | Total Timing |
|------|-------|------|-------|---------|--------------|
| 500  | 10    | 2.32 | 0     | -       | 10           |
| 750  | 10    | 3.52 | 0     | -       | 10           |
| 1000 | 10    | 4.72 | 0     | -       | 10           |
| 1100 | 12    | 5.92 | 0     | -       | 12           |
| 1200 | 15    | 7.12 | 0     | -       | 15           |
| 1300 | 17    | 8.22 | 0     | -       | 17           |
| 1400 | 19    | 9.42 | 0     | -       | 19           |
| 1500 | 21    | 10.6 | 0     | -       | 21           |
| 1600 | 23    | 11.5 | 0     | -       | 23           |
| 1700 | 25    | 12.7 | 0     | -       | 25           |
| 1800 | 25    | 13.9 | 0     | -       | 24           |
| 1900 | 25    | 15.0 | 0     | -       | 25           |
| 2000 | 25    | 16.2 | 0     | -       | 25           |
| 2100 | 25    | 17.4 | 2     | ADV     | 27           |
| 2200 | 25    | 18.6 | 2     | ADV     | 27           |
| 2300 | 25    | 19.8 | 3     | ADV     | 28           |
| 2400 | 25    | 20.7 | 3     | ADV     | 28           |
| 2500 | 25    | 21.9 | 4     | ADV     | 29           |
| 2600 | 25    | 23.0 | 3     | ADV     | 28           |
| 2700 | 25    | 24.2 | 2     | ADV     | 27           |
| 2800 | 25    | 25.4 | 0     | -       | 25           |
| 2900 | 25    | 26.6 | 2     | RET     | 23           |
| 3000 | 25    | 27.8 | 3     | RET     | 22           |
| 3100 | 25    | 28.9 | 4     | RET     | 21           |
| 3200 | 25    | 30.1 | 5     | RET     | 20           |

Values for IGN RET-ADV/LOAD are limited to a maximum 25 degrees advance, and a maximum 25 degrees retard.

There are hundreds of possible timing curves available with the CPi to suit any engine, the previous examples are only hypothetical.

## Optional Advance Switch



This option allows a dash mounted switch to activate the additional ignition advance timing programmed into this screen. The switch connections are one side to +12 volts, and the other side of the switch into pin12 via a blue wire. Note, this cannot be used if Knock sensing is needed since both share the same input wire. See Pin12 Function in Hidden Settings information. The proper function must be selected!

## RUNUP



Intended for aircraft with twin plug engines using a single Cpi to test operation of CPi coil pack(s).  
4cylinder with single coil pack: Pressing the PLUS button will cut out spark on the coil pack.

4 cylinder using twin coil packs on 8 spark plug engines: Pressing the PLUS button will cut spark on the primary coil pack for 3 seconds. Pressing the MINUS button will cut spark on the secondary coil pack for 3 seconds.

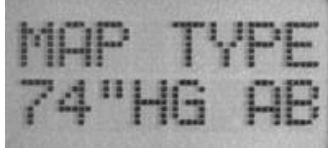
6 and 8 cylinder: Pressing either plus or minus buttons on the keypad will cutout ignition completely.

## Hidden settings.

**These can be accessed by holding down the left arrow button when powering up the CPI unit.**

Plus and minus buttons are used to change the settings.

### Map Type



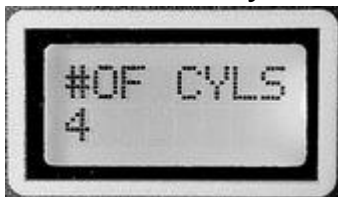
74" HG will be the aircraft setting. There are a variety of other settings for sensors which can be externally connected.

### RPM Range



Allows selection of RPM range resolution. 4500, 9750 or 15,000 rpm can be selected.

### Number of Cyls



Number of cylinders of the engine. 4,6 or 8.

### Number of Coils



Multi or Single. Multi is used with coil pack or coil-on-plug. Single is for engines with only one ignition coil which use a distributor.

### Coil Time



Adjusts the charge time or dwell of the coils in milliseconds. Default is 3.5mS. Increasing may help spark if running high boost on turbo/supercharged engines. Increasing dwell will increase current draw of the coil pack, and could cause the coil pack/ignition fuse to blow at high rpm. If experimenting with larger coiltime settings, rev the engine in neutral and monitor ignition current. One way to monitor current is to pull the coil pack fuse out and substitute your ammeter leads into the fuse socket. Fuse should be at least 50% greater amperage capacity than what you observe on

the meter at redline.

### Coil Test



This screen turns on coil test by pressing +1, turns off with -1. Remove all spark plug wires and place them close to ground so the spark can jump.

When turned ON, 1 coil will spark every 32.7 milliseconds. **Do not turn this ON when the plug wires are connected to the engines spark plugs, because fuel could ignite in the intake manifold.** See troubleshooting section.

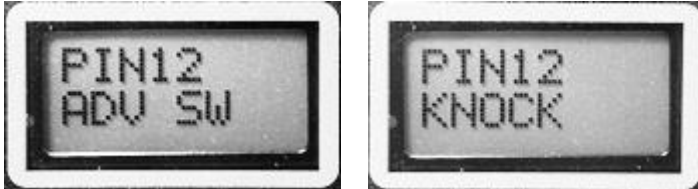
This screen turns on coil test by pressing +1, turns off with -1. Remove all spark plug wires and place them close to ground so the spark can jump.

## Config1 (no photo)

This value may control various functions in software. Factory set and locked. Change only if instructed to do so from the factory.

## Pin12 Function

Used to select either Knock sensing or Ignition Advance Switch.  
Press +1 to change the Pin12 function:



## MAP CALI (no photo)

Offset value used at the factory to calibrate the MAP sensor.

## Troubleshooting

### Testing the coil pack for spark (4 & 8cylinder) Caution high voltage!

The easiest test if the CPi unit is installed is to use the COILTEST function in the Hidden Settings area. This will send test signals out all channels of the CPi to the coil pack(s) connected.

Disconnect plug wires from engine spark plugs and place wires ends close to ground with a small gap to see the spark jump. You can also use spare spark plugs as shown in the photo, note how wires are connected in the photo.

Never test for spark by just removing the plug wires. Note how wire and plugs are connected in this photo.

Connect the black wire to ground and the red wire to +12 volts.

If the CPi unit is not connected and you just want to test the coil by itself then momentarily touch +12v momentarily to the input marked A or D on the black connector. A input fires one of the coils, D input fires the other coil. If you touch too long this may blow the fuse or pop the breaker.



### Spark plugs

We recommend resistor type spark plugs only. Non resistor type may cause electrical interference.

### Spark plug wires, and Interference Problems

Always use radio suppression type spark plug wires. NEVER use solid core wires.

Recommended wires:

Magnecor, MSD superconductor, NGK, OEM or factory carbon string, Accel 8.8 yellow.

## Troubleshooting continued

### **Will not start:**

1. Check power and ground connections.
2. Check Hall sensor alignment.
3. No sync magnet being seen by the CPi unit. Check TRIG SYNC window and make sure all magnets are being seen.
4. Check # OF CYLS setting for 4,6,8 cylinder to make sure it is correct for the engine. This is in Hidden Settings so to access these you must hold down the left arrow button then power up the CPi.

### **Runs but no power**

1. If you don't have a knock sensor installed set KNOCK RETARD to zero and KNOCK SENSE to 1.
2. Keep knock (yellow) wire away from spark plug wires.
3. Magnets positioned incorrectly, so timing is retarded too much. Check timing with a timing light (non-knob or non-delay type). See MAG POS.
4. RPM IGNITION values are too low.

### **RPM ERR message or engine miss:**

1. Check alignment of Hall sensor over magnets. Loosen Hall sensor mounting bolts and try adjusting Hall sensor.
2. Check Hall sensor air gap. Should be close to .060".
3. Interference from plug wires.
4. Make sure that all CPi sensor wiring and Hall sensor cable is not close to spark plug wires or any high current/voltage wires.
5. Check spark plug gap, possibly too large. Reduce to confirm.

### **Coil pack fuse blows all the time:**

1. Hall sensor and magnets not aligned.

### **I only received one magnet:**

1. The magnets stick together really well. Separate them with your fingers.