CPi

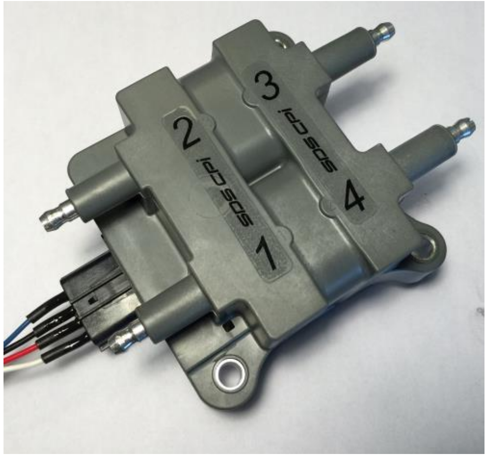
CoiL Pack iGNition system

Software version 2.4
Jan 27, 2016

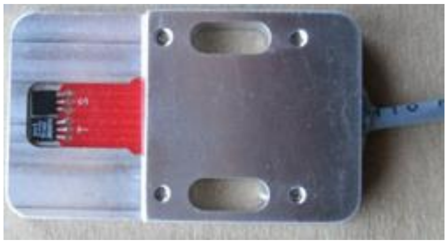
For 4,6 and 8 cylinder 4 stroke applications.
Please read the entire manual before beginning installation.

CPI control unit

Coil pack



Hall sensor



System Description
The CPi unit is a microprocessor based ignition unit designed to trigger waste-spark type coil packs with built in igniters. The CPi cannot trigger traditional non-igniter type coils or coil packs. The CPi may be able to drive some coil-on-plug type coils if they have built in igniters, although it would be best to contact us or send us 2 coils for testing.

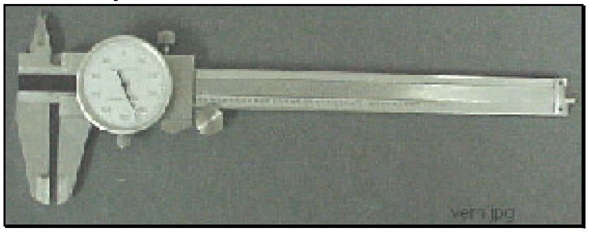
Engine spark timing is fully programmable for both RPM and load(manifold pressure or throttle position). Triggering is accomplished with magnets attached to the crankshaft pulley and a Hall effect sensor fitted to the timing cover. As such, timing variations relating to belt and chain deflection or gear harmonics are eliminated.

Theory of Operation

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, while one cylinder is on compression, the other on exhaust.

Once the system has been calibrated using a timing light by setting the MAG POS (MAGNET POSITION) value, then 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.

Items required:



Use this end to check hole depth when drilling holes for magnets

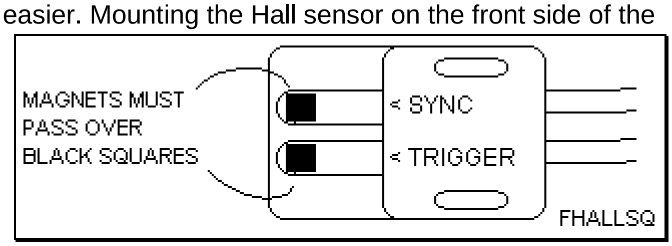
Vernier calipers as shown above.
Drill press.
#30 drill bit for magnet holes.
#25 drill bit for mounting bolt holes.
#10-24 tap.
5 minute epoxy.
Tools to remove crank pulley.
Center punch.
Use of a lathe is highly recommended.

Magnets
The magnets are somewhat fragile, so handle them carefully. They also stick to anything ferrous, making them easy to lose. Magnets also stick together tightly. Separate them with your fingers.

Mounting the Hall Sensor
Some important tips:

1. **You MUST decide where the Hall sensor will be mounted before mounting any magnets.**
2. **This is the most important part of the system installation.**
3. **Mounting the Hall sensor requires fabricating a very solid bracket that will not vibrate or deflect.**
4. **Build a mounting bracket that is strong enough to lift the whole engine.**
5. **The Hall sensor can be mounted anywhere around the pulley that is most convenient, and then the magnets will be positioned relative to where the Hall sensor is mounted.**
6. **Pulley must be thick enough to drill magnet holes at least .120" or 3mm in depth with a #30 diameter drill bit.**
7. **We recommend a minimum clearance between sensor and magnet of 1mm or .040" in the case of solid pulleys and at least 1.5mm or .060" in the case of rubber damped pulleys.**

Try to find a location that will minimize the span of the mounting bracket, so the bracket is shorter and therefore stronger. Look for two bolts on the timing cover that you can span with some thick steel or aluminum. The sensor may be mounted to face either the front or the rear of the pulley depending on where the triggering magnets would be best located and clearance from other interfering items. Usually mounting the Hall sensor behind the crank pulley is the best place, and will make building a bracket much easier. Mounting the Hall sensor on the front side of the pulley will require longer mounting bolts and a stronger bracket to stop vibration. Also front mounting may make changing the belts difficult.



The Hall sensor assembly should be positioned so that the sensor element clears the crankshaft pulley surface by 2 to 3mm or .080" to .120". The square black sensor element must be placed so that the magnets on the crank pulley spin over its center with 1 to 1.5mm or .040" to .060" clearance. Magnets should protrude about 1 to 1.5 mm or .040" to .060" past the pulley face. The sensor bracket should be initially positioned in the center of its adjustment slot to allow maximum movement in or out for final placement once the magnets are in the pulley. The sensor is supplied with #10-24 Allen bolts. Slot spacing is 1.100 inch. Use a #25 drill and tap with a #10-24 tap.
The wires leading from the sensor should be securely wire- tied every few inches to avoid vibration breakages.

Crank pulley

Check for TDC marks on the pulley and timing cover. It is best to remove the #1 spark plug, and insert a piece of welding rod into the cylinder, and then verify that the TDC marks are actually correct on the pulley and timing cover. In some cases, the pulley may have been changed on the engine, and could have come from a different model year, so the timing marks could be wrong.

If the pulley has no marks for TDC, then put the #1 piston to TDC, and make your own marks on the timing cover and pulley. It's a good idea to paint the pulley timing marks with some white paint or correction fluid(white-out), so that they are easy to see with a timing light.

If the engine is not at TDC #1 when marking the pulley for magnet placement, the magnets will be in the wrong position and the engine will not run.

Locating the position of the #1 Trigger Magnet
4, 6 and 8 cylinder engines.
Very Important.

You should first know the direction of rotation of the engine when it is running. Most engines rotate clockwise when running, although some such as front-drive Honda rotate counter-clockwise.

Rotate the crankshaft to TDC #1 and leave it there.

Draw an arrow on the pulley to indicate direction of rotation.

The #1 magnet should positioned approximately 80 degrees from the Hall sensor, in the direction of the arrow. You must mark the pulley at this location. In this example the #1 magnet location is approximately in the five o'clock position. You do not need to be perfectly accurate here, so anywhere from 75 to 85 degrees is acceptable. You can use the 80 degree cardboard template to help locate the position of the #1 magnet.

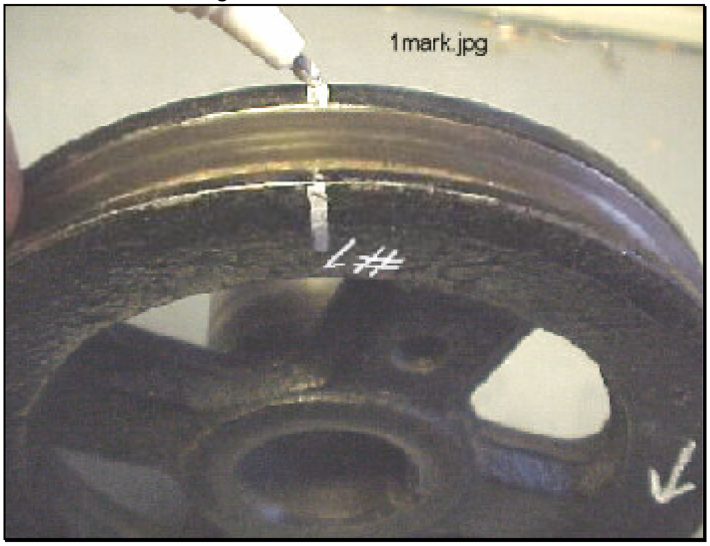
In this example, the engine rotates clockwise as shown by the arrow marked on the pulley. If this engine happened to rotate counter-clockwise, like a front-drive Honda, then the #1 magnet mark would be at roughly the one-o'clock position on this particular engine shown.

In this photo the crank is at TDC #1.

1MAGNET.JPG

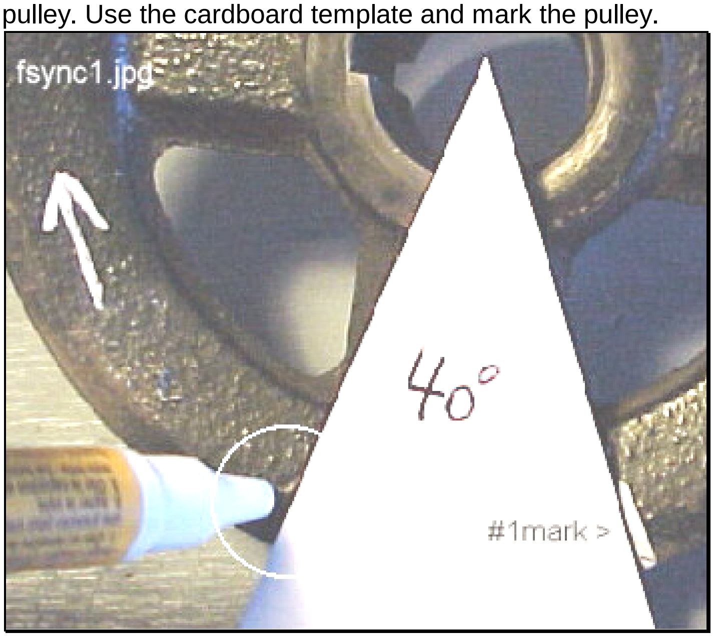
The pulley can now be removed.

Using a marking pen, draw the #1 magnet mark through the belt groove around to the back side of the pulley. In this installation the magnet will be in the back side.

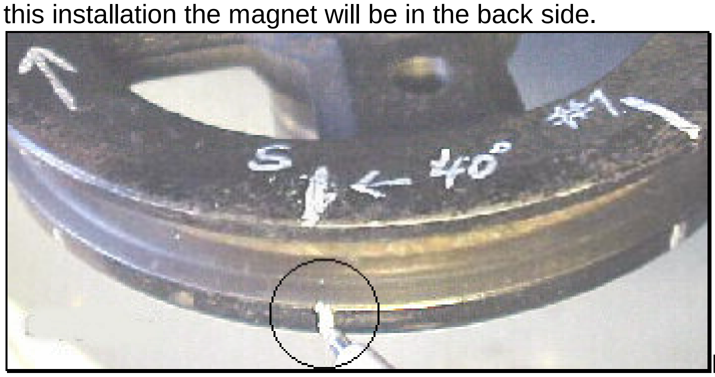


Locating the position of the sync magnet (4, 6, 8 cylinder)

The location of the sync magnet is 40 degrees from the #1 magnet mark in the direction of the arrow drawn on the pulley. Use the cardboard template and mark the pulley.

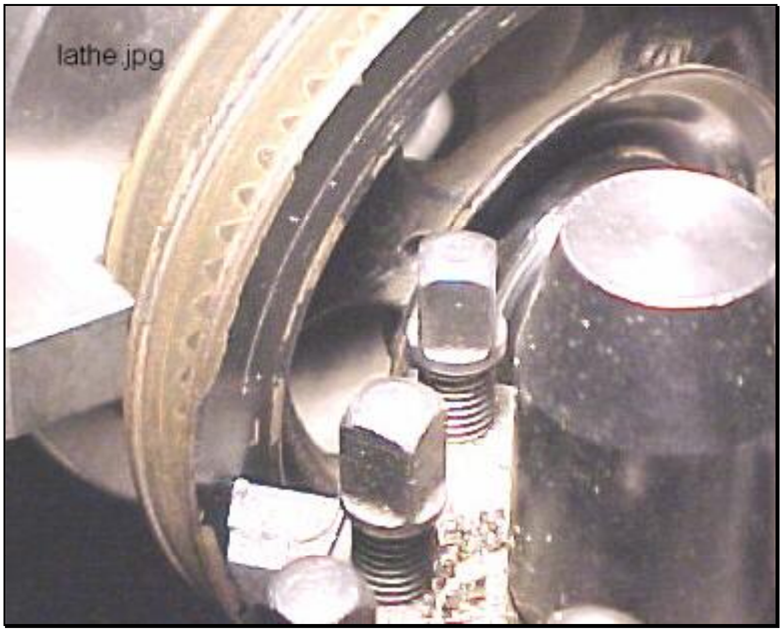


Using a marking pen, draw the sync magnet mark through the belt groove around to the back side of the pulley. In this installation the magnet will be in the back side.



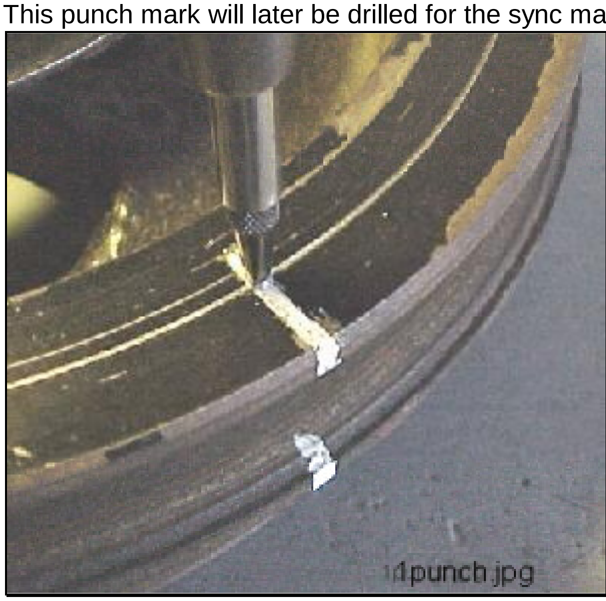
FSYNC2.JPG

Lightly scribe a groove around the pulley with a lathe on the surface of the pulley where the magnets will be mounted. In this case on the back side of pulley.

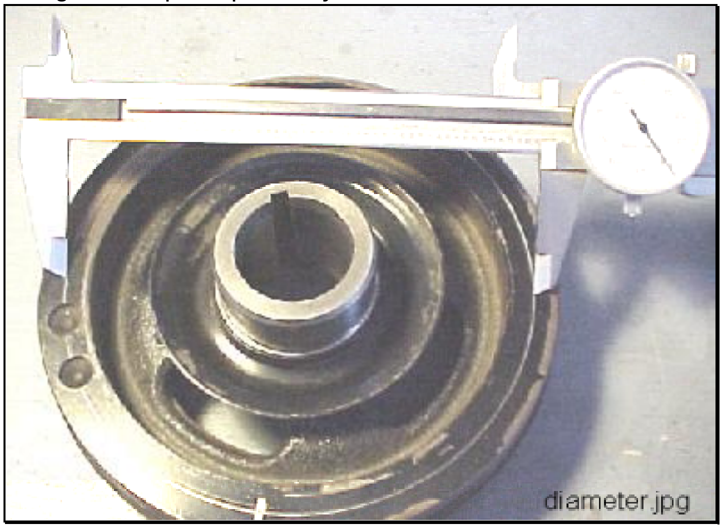


Pulley in the lathe. We recommend that you don't run the lathe motor, just rotate the chuck by hand slowly, with only light pressure on the cutting tool.

Centerpunch the pulley where the #1 mark crosses the scribed line in the pulley. This punch mark will **later** be drilled for the #1 magnet. Also centerpunch the pulley where the sync mark crosses the scribed line in the pulley. This punch mark will later be drilled for the sync magnet.



Using dial calipers, precisely measure the diameter of the scribed circle. Write down this measurement for later.

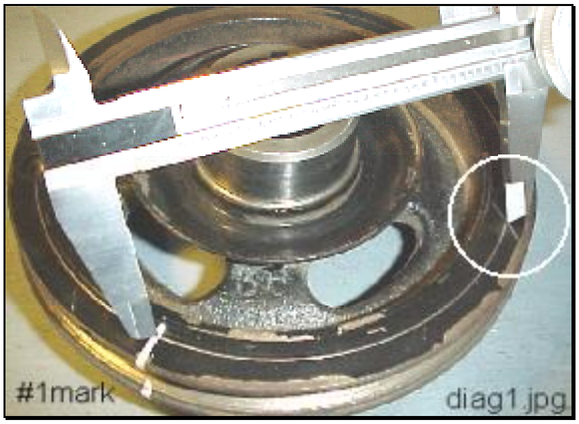


Locations of remaining trigger magnets
4 cylinder engines only:

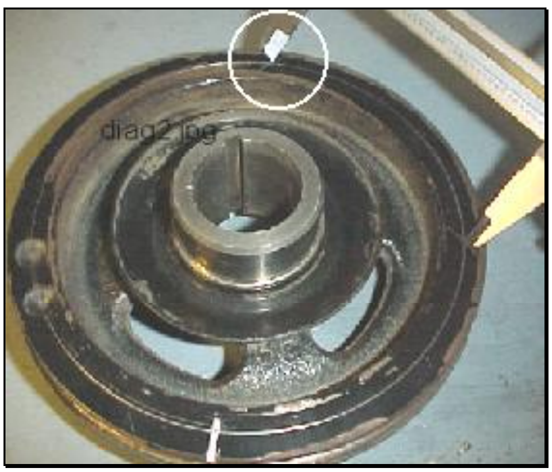
On 4 cylinder engines one more trigger magnet is used 180 degrees from #1 mark.
The diameter of the lathe scribed circle divided by 1.414 will give the dimension of 4 equidistant points along this scribed line when using calipers or dividers.

Example:

The pulley below has a scribed diameter of 5.340 inches. 5.340 divided by 1.414 equals 3.776 inches. In the photos the calipers are spread to 3.776, so in two steps we can locate the position of the second magnet. Do this step carefully and be as accurate as possible.



Scribe an arc with the calipers.



Scribe another arc at the top. This point is 180 degrees from the #1 mark on the pulley. This point can be center punched for drilling.

See drilling holes for magnets section.

Locations of remaining trigger magnets
6 cylinder engines:

On 6 cylinder engines two more trigger magnets are used, 120, and 240 degrees from the #1 mark.
To calculate the straight line distance between 3 magnet points use the following method:
Measure the diameter of the lathe scribed circle, divide this number by 2, then multiply by 1.732.

Example:
The pulley below has a scribed diameter of 5.340 inches.
5.340 ÷ 2 = 2.67
2.67 x 1.732 = 4.624

In the photos the calipers are spread to 4.624, so in two steps we can locate the position of the two remaining magnets. Do this step carefully and be as accurate as possible.

Scribe an arc with calipers and center punch this location for drilling.

Scribe the last point with calipers and center punch this location for drilling.

Locations of remaining trigger magnets
8 cylinder engines:

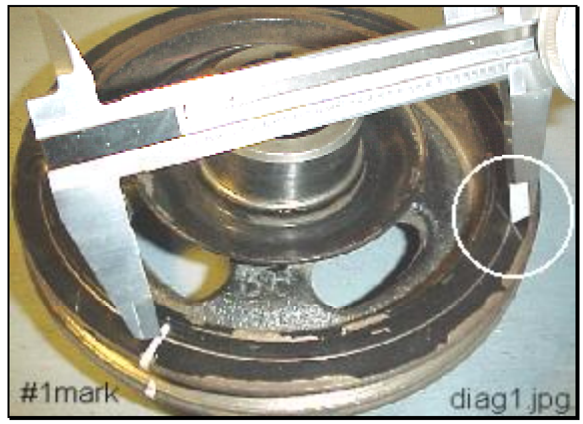
On 8 cylinder engines three more Trigger magnets are used, 90, 180 and 270 degrees from the #1Trigger magnet location.

The diameter of the lathe scribed circle divided by 1.414 will give the dimension of 4 equidistant points along this scribed line when using calipers or dividers.

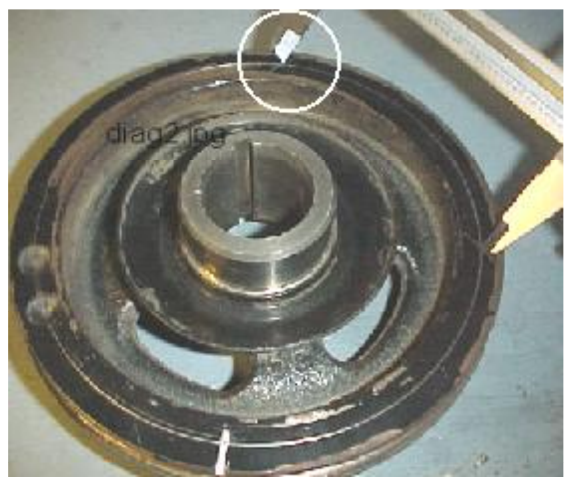
Example:

The pulley below has a scribed diameter of 5.340 inches. 5.340 divided by 1.414 equal's 3.776 inches. In the photos the calipers are spread to 3.776, so in two steps we can locate the position of the second magnet. Do this step carefully and be as accurate as possible.

Scribe an arc with the calipers and center punch this arc where it crosses the scribed line.



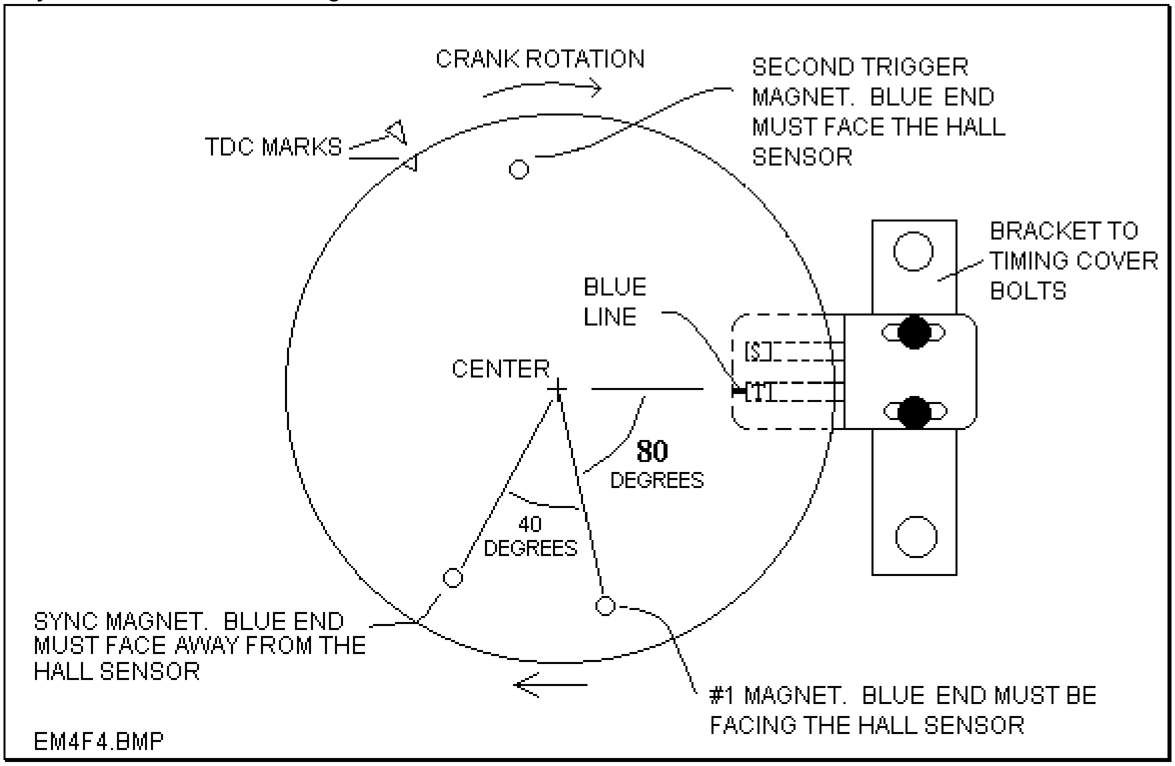
Scribe another arc at the top. This point is 180 degrees from the #1Trigger magnet mark on the pulley. This point can be center punched for drilling.



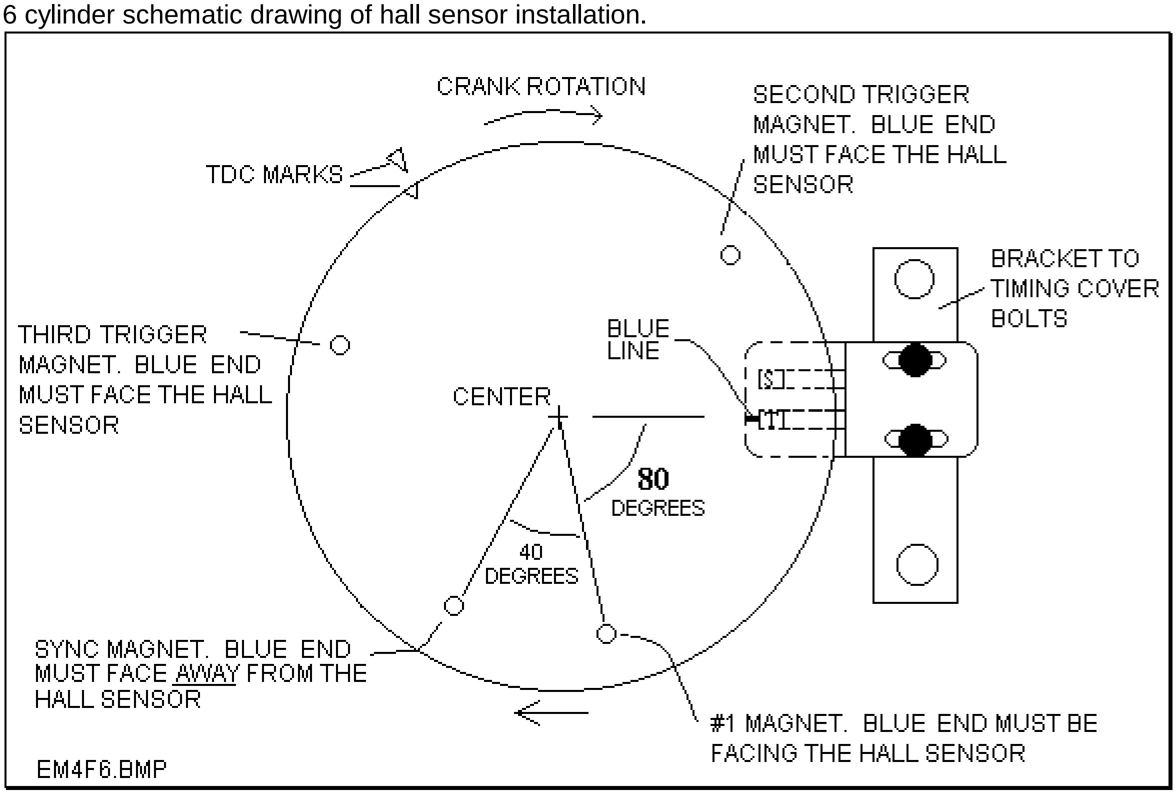
Scribe the last point with calipers and center punch this location for drilling.

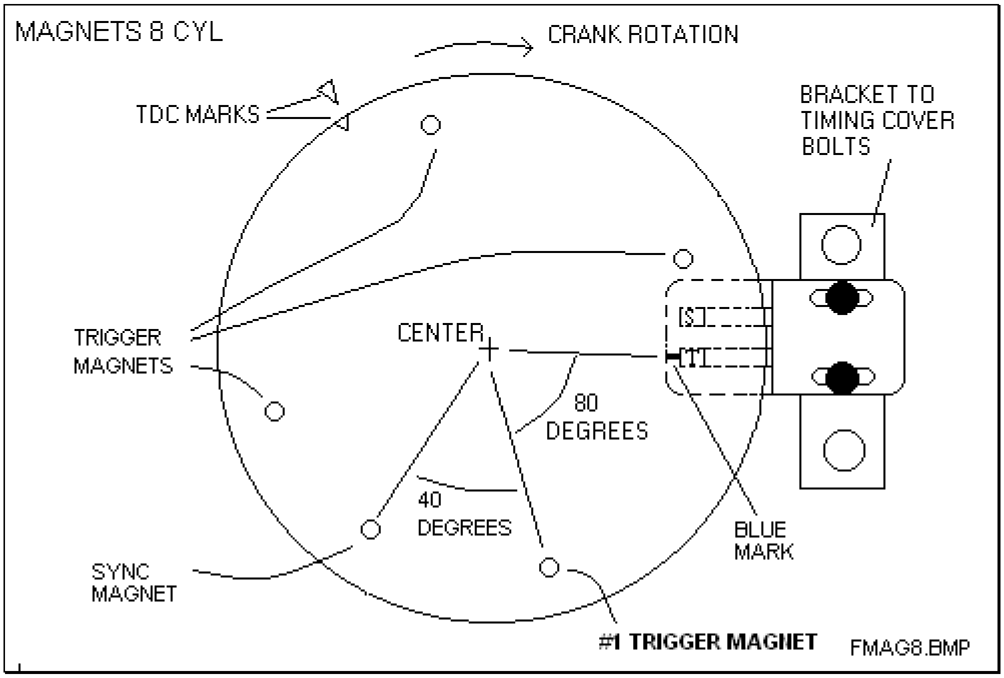
See drilling holes for magnets section.

4 cylinder schematic drawing of a hall sensor installation.

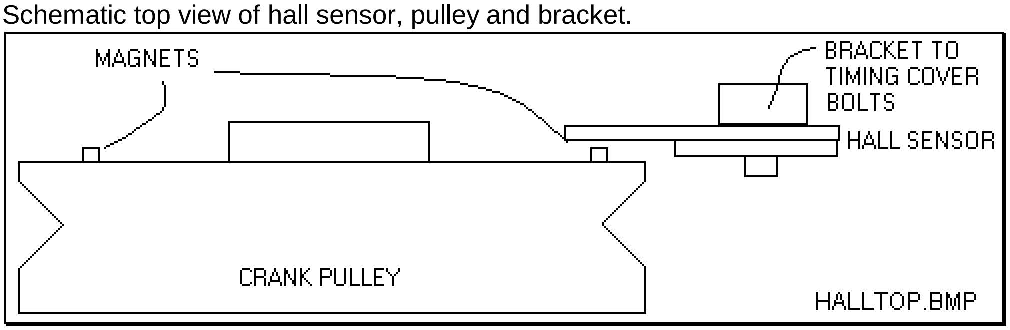


6 cylinder schematic drawing of hall sensor installation.





Schematic top view of hall sensor, pulley and bracket.



Drilling holes for magnets

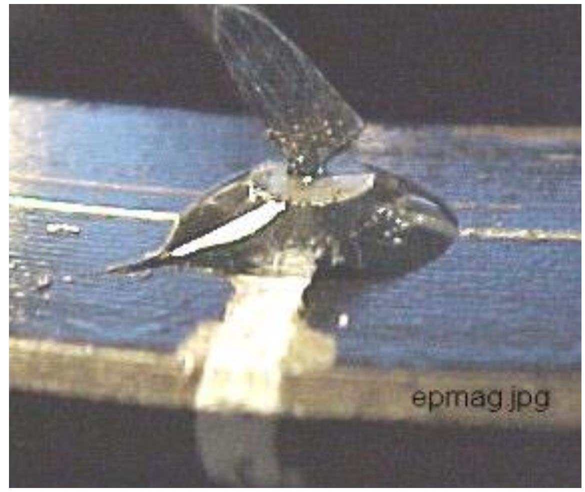
Drilled holes should all be the same depth, so drill slowly and measure depth carefully. Magnet holes are best drilled with a #30 drill bit which is 0.1285" diameter. A 1/8" bit may also be used but can be a sometimes too tight, making the magnet & epoxy difficult to fit into the hole, due to hydraulic effect.

Often times the magnets will spring up out of the hole, so it's a good idea to have a heavy object to place over the magnets to hold them down in the holes until the epoxy glue has dried.

The magnets are 4.7mm or .187" long. Depth of the hole should allow the top of the magnet to sit about 1.5mm or .060" above the surface of the pulley, so hole depth should be about 3 to 3.5mm or .120" to .135" deep. Drill carefully and check the depth of the hole with the end of the calipers.

If the magnets need to be flush with the pulley surface, then air gap to the Hall sensor will need to be reduced because of a weaker magnetic field. This will make Hall sensor alignment more difficult. Flush mounting is not recommended unless the pulley is aluminum.

Gluing magnets
IMPORTANT!
Trigger magnets go into the holes with the BLUE end visible, facing the hall sensor.
The Sync magnet goes into the hole with the BLUE end inside the pulley, facing away from the hall sensor.



Insert a magnet into the hole without epoxy first to make sure it will fit. Do not use a hydraulic press or hammer to push in the magnets, this will break the magnets. Holes should be clean and dry. Mix some 5 minute epoxy, then fill each hole with epoxy, then push the magnets into the holes. Have a heavy object you can place over top of the magnets to hold them down until the epoxy dries.

The pulley and Hall sensor can now be installed on the engine. **Make sure the pulley will rotate without touching the magnets**. Air gap from magnets to the sensor should be about 1 to 1.5mm or .040” to .060”. Magnets must pass over the small black square in the Hall sensor, so this can be adjusted by loosening the mounting bolts then sliding the sensor until the black square is across from one of the magnets.

Coil pack mounting and care

Gray type coil pack and 6cyl coil pack can be engine mounted if desired.

Mount the coil pack at least 12 inches(30cm) from hot exhaust components. Build a heat shield if necessary to reflect heat.

In high rpm applications like racecars and airplanes it may be a good idea to duct cool air onto the coil pack to keep if from running too hot.

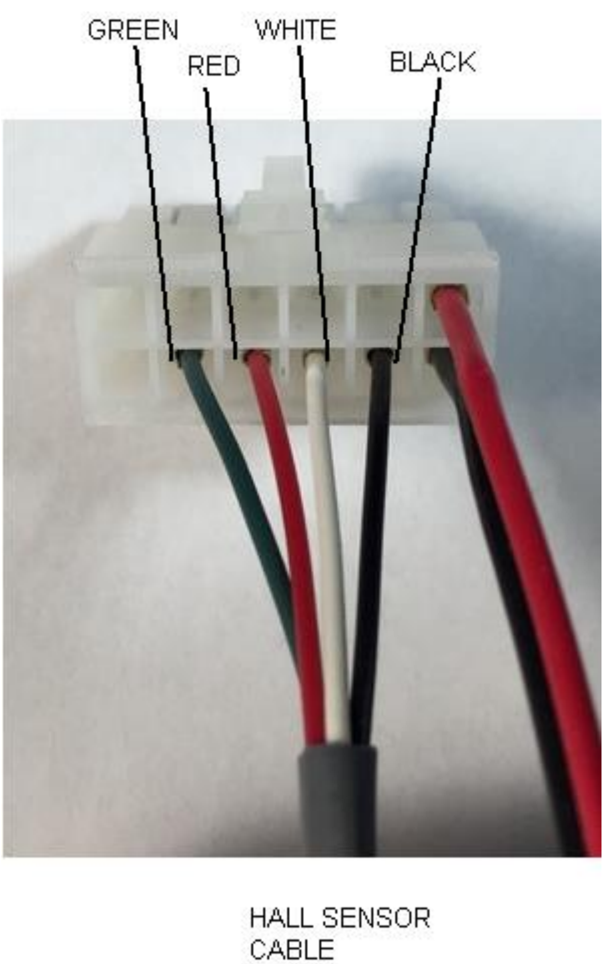
Wiring connections

Coil pack hookup:
Thick Red to key switched +12 volts.
Thick Black to ground.
Signal cable(s) see further ahead in manual.

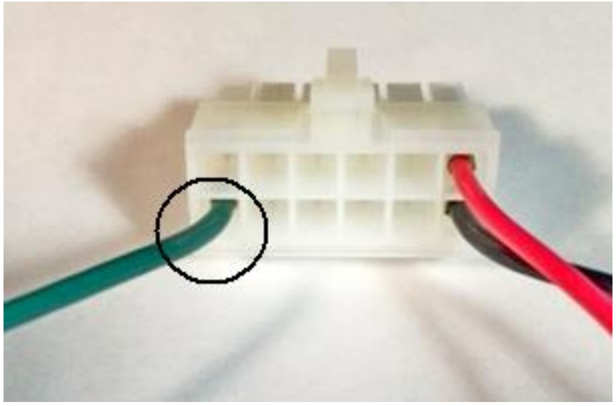
Fuses:
On the coil pack red wire fuses or breakers must be used. Breaker is recommended for aircraft.
4cyl: 10 amp.
6cyl: 15 amp.
8cyl: Use 2 fuses or breakers, 10 amp for each coil pack.
4cyl twin coil packs, Use 2 fuses or breakers, 10 amp for each coil pack.

Leave the fuse out or leave 12V wire unconnected until you have the hall sensor installed and all magnets are aligned and being seen for 2 to 3 degrees of crank rotation.
The best place to connect this wire is to the original power wire for the factory ignition circuit. The fuse or breaker could save the coil pack from damage caused by incorrectly installed magnets and hall sensor. **Always disconnect this wire when rotating the crankshaft to check Hall sensor and magnet alignment.**

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



Tach output, CPi power and ground wires

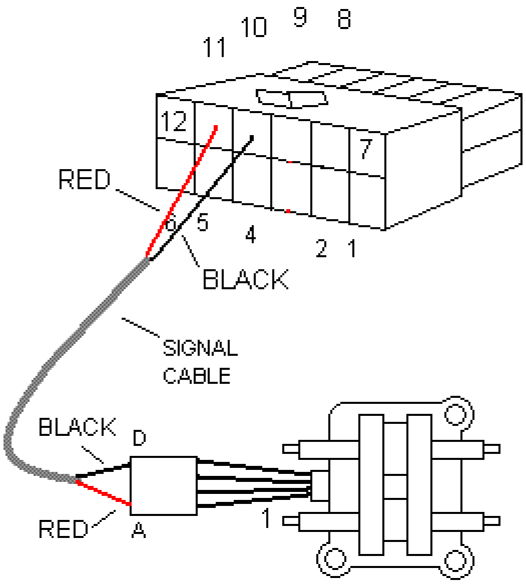


The Tach output wire(circled in photo) goes to the dash tachometer signal input.

On older vehicles, if your automotive factory tach was triggered by the negative side of the ignition coil, and your tach does not function with the engine running, then you will require an MSD8920 tach adapter.

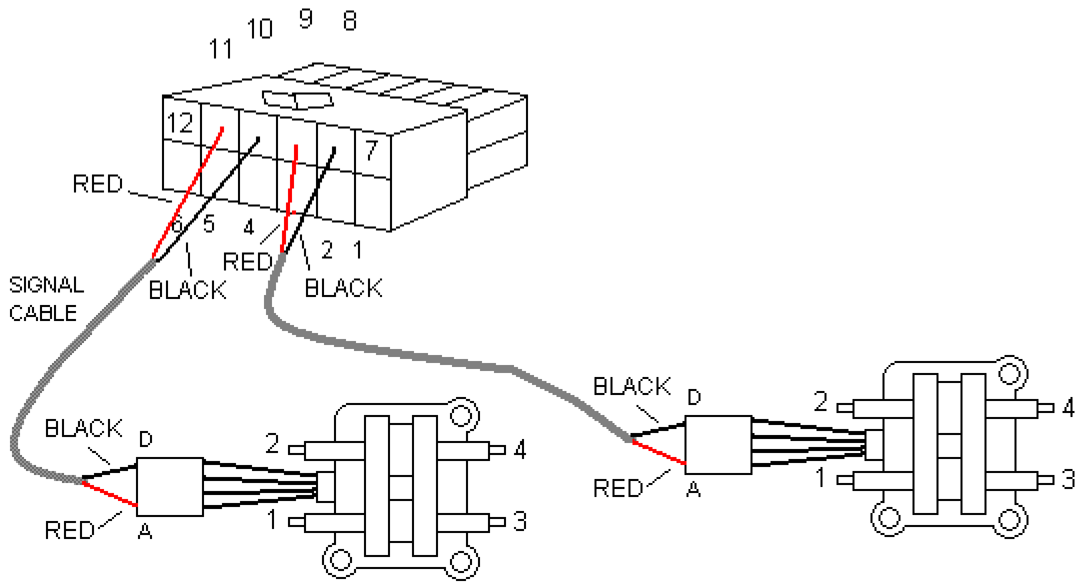
Power, red wire in photo top right corner, goes to key switched fused 12 volts. Current draw is approximately 100mA or 0.1amps. A 1 or 3 amp fuse can be wired inline with the red wire if the power source has no fuse already.
Black wire in photo bottom right corner, goes to a known good ground such as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

CPi signal cable connections 4cyl



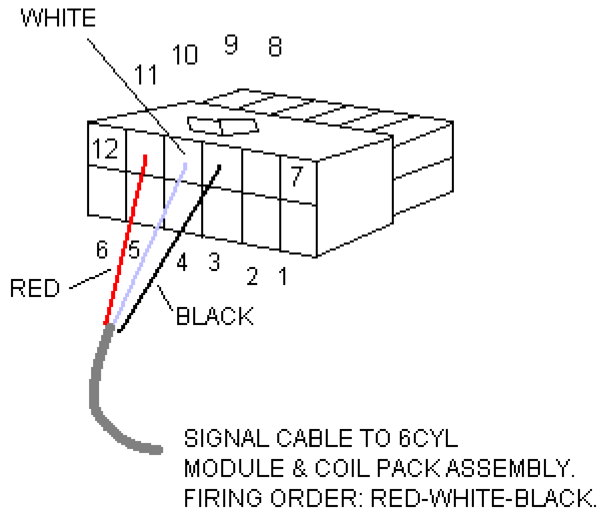
fs

CPi signal cable connections 4cyl Twin spark plug per cylinder (air cooled)

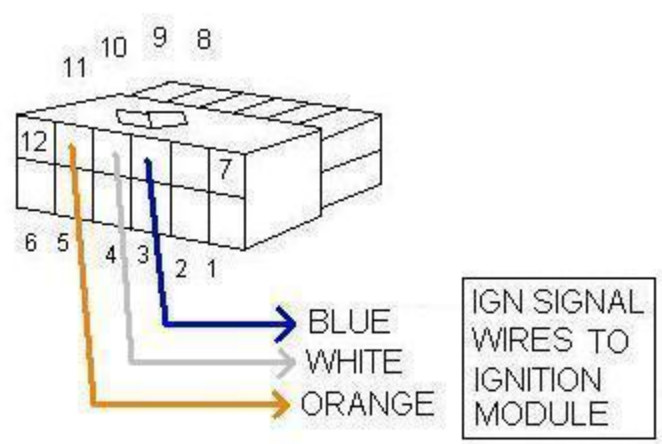


CPi ignition signal cable connections 6cylinder

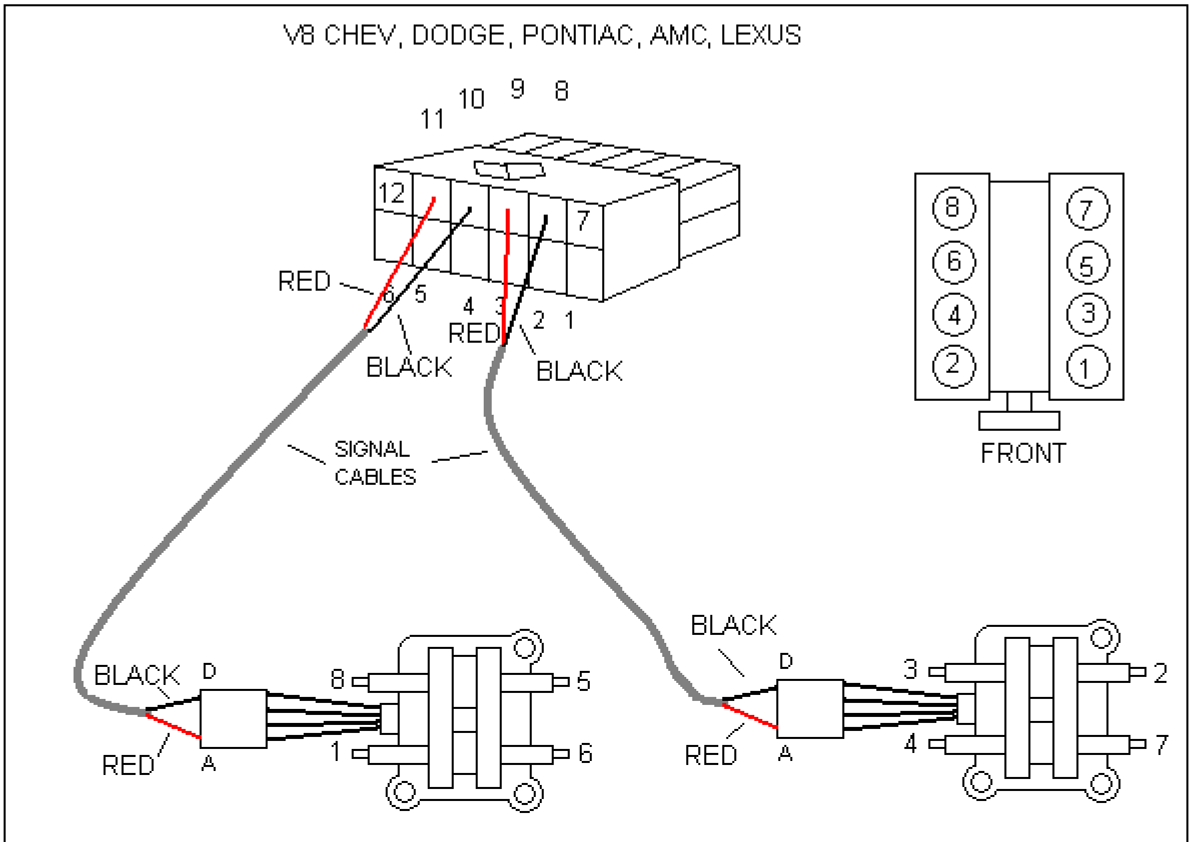
Automotive:

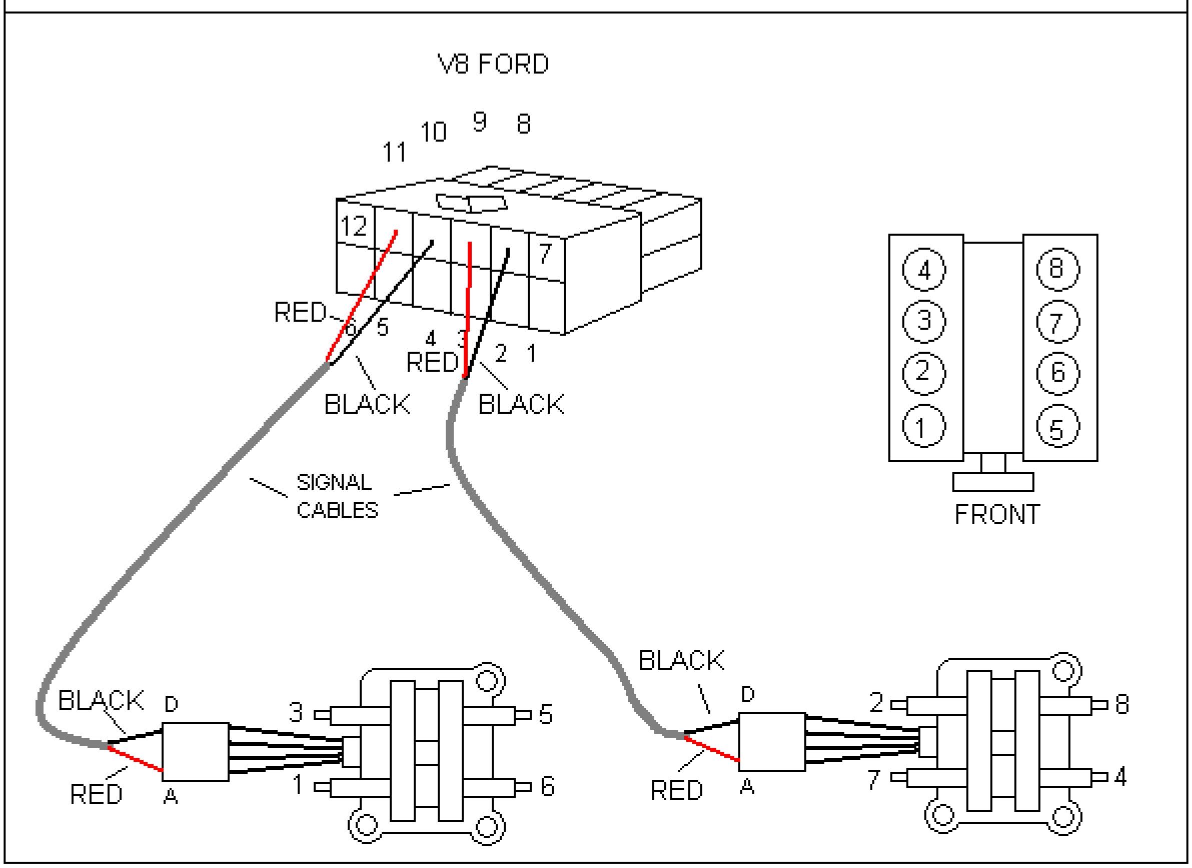


Aircraft:



CPi signal cable connections 8cyl





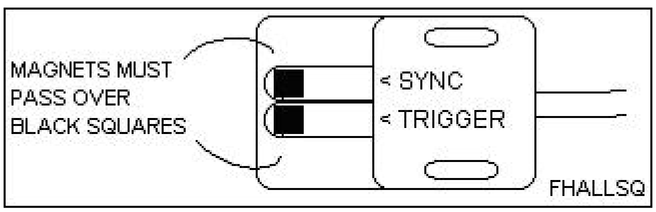
Optional Knock Sensor

Hookup:
Harness, if equipped, will have a 2-pin plug with a black and a yellow wire. The black wire will need to be grounded with the CPi ground wire. Yellow wire goes into position just above the Tach Output wire in the white connector.

Mounting:
The sensor should be mounted in the block, within 2 inches of the top, close to the cylinders. In most cases, mounting it in the head is also a poor choice because of valvetrain noise.

ALIGNING THE 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.

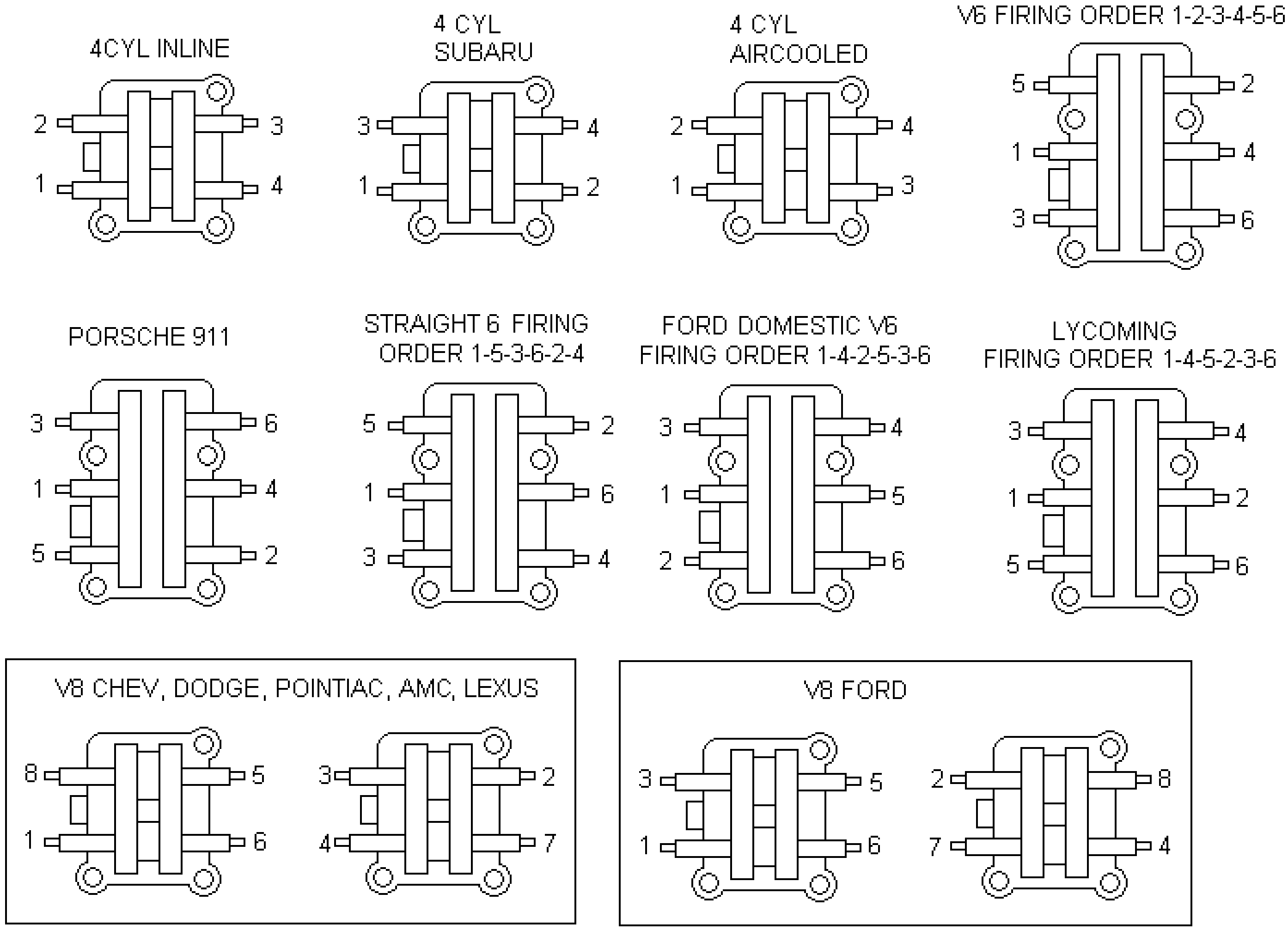


Important! Disconnect power to the coil pack to disable the spark while rotating the crankshaft.

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. 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.

Tips: 1. Trig and Sync will only show YES while a magnet is over the sensor so you have to move the sensor slowly and also rotate the crank very slowly to check alignment. Good alignment is very important.
2. Each magnet should be SEEN for at least 2 to 3 degrees of crank rotation.
<u>Note</u>: This window has no use once the engine is running, since the sampling rate of the programmer is only about twice per second.

Spark plug wire connections to coil pack(s).



Technical notes:
Even though the Chev LS has a different firing order, the numbering of coil packs is the same as other V8 engines, this due to the waste spark arrangement. The same applies to Ford old V8's vs. 5.0L. Spark plugs fire on compression and exhaust.

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.

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 aircraft with 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 boost 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

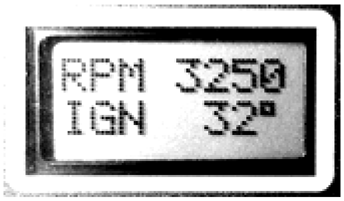
This screen is much like a dashboard, showing a live reading of engine RPM's, Manifold pressure/vaccum (-5.7 is vacuum amount) and current amount of ignition timing on right side. On automotive applications, a minus symbol indicates vacuum in inches mercury, and if the sensor sees boost pressure the reading will have a plus symbol in front of it with readings in PSI. On aircraft applications, the display is absolute inches mercury with inches symbol to the right of the reading and no sign before the reading. Proper readings with a typical engine at idle should be around –15 to –22, or on airplanes 8 to 15(inHG absolute). Engines with racecams may not make as much vacuum.

If the optional knock sensor is connected, and the system senses knock the degree symbol will change to a letter "K" indicating there is some amount of knock retard added into the timing.

Ignition Programming

Ignition timing requirements differ widely between various types of engines so we can only offer general guidelines for ignition values. Optimal timing is best found on a dyno or by driving the car. If you have no idea what your ignition curve should look like, programming should be done by somebody who does. **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



There are 38 RPM Ignition windows, above is one of them, 3250 rpm, where ignition is programmed at 32 degrees BTDC. These are where the main ignition programming of the system is done. For example, if you want timing at 20 degrees BTDC at 2500 RPM go to RPM IGN 2500 and enter 20. Etc.

Most engines want total timing between 5 and 15 degrees BTDC at idle- As RPM is increased, total timing is usually slowly increased from 1500 RPM up to 2500 to 4000 RPM- where full advance is usually in - most engines like 25 to 35 degrees total timing here. Often this figure is maintained right up to redline.

Here is a typical RPM only timing curve along the lines above. This will work fine on most engines if you are unsure of what values to enter.

RPM	TIMING
500	10
750	10
1000	10
1250	10
1500	13
1750	16
2000	19
2250	22
2500	25
2750	28
3000	28
3250	28
3500	28
3750	28
4000	28
ETC.	

For most engines running adequate octane fuel, a simple timing curve using only RPM offsets often gives excellent results. For RPM only ignition mapping, enter 0's in all the MP ADV RET parameter slots.

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. On systems not using a MAP sensor, the throttle position sensor is used for load information. RET refers to retard, and ADV refers to advance.

ADVance adds to your timing, usually done under vacuum (negative MP) to help fuel economy (left photo above). RETard reduces timing, usually done on boost(positive MP) to prevent detonation on turbo/supercharged engines (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 will be reduced significantly, and detonation may still occur. On most engines, timing on boost should not be less than approximately 15 degrees total(RPM IGN minus RETard), since this could shorten the life of some engine components. In turbo applications the engine is more efficient running lower boost pressure with more ignition timing.

Advance is useful to improve fuel economy and lower emissions under part throttle conditions, which is usually from -18" to -9" vacuum. Advance can be programmed by pushing the -1 button on the programmer.

Below are some example values for timing. Some advance is used under vacuum to help fuel economy, and some retard is used on boost to help prevent detonation. The total timing column does not show all possible results. For instance the engine could be running at 4000 RPM with 15 PSI boost, so in this case the total timing would be 29-15=14 degrees.

RPM IGN	VAL	IGN RET-ADV/LOAD			TOTAL TIMING
500	10	-26.70	0	RET	10
750	10	-25.80	0	RET	10
1000	11	-24.90	0	RET	11
2250	29	-20.40	0	RET	29
3000	29	-17.70	2	ADV	31
3500	29	-15.90	3	ADV	32
3750	29	-15.00	5	ADV	34
4000	29	-14.10	7	ADV	36
4250	29	5.34	3	RET	26
4500	30	5.78	5	RET	25
4750	31	6.22	8	RET	23
5000	32	6.66	10	RET	22
5250	32	7.10	12	RET	20
5500	34	10.20	13	RET	21
5750	35	15.00	15	RET	20

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

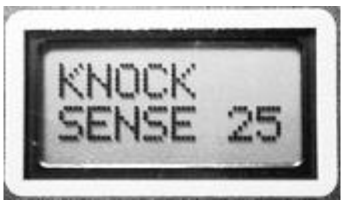
There are hundreds of possible timing curves available with SDS to suit any engine, the previous examples are only hypothetical as mentioned before, efficient timing curves are best developed on the dyno.

Knock Sensing Programming
If you do not have the knock sensor option, set KNOCK RETARD to 0.
The knock sensing option allows you to adjust the sensitivity and selectivity of the EM-5 to hear knock from the sensor and adjust the amount of ignition retard per knock. The knock sensing option can take the place of large amounts of MAP retard in some cases however, total reliance on the sensor while running unrealistically high amounts of spark timing may lead to running problems. **We recommend using the knock sensor as a safety device rather than a primary timing control.**

The knock sensing in the CPi will retard the timing a maximum of 15 degrees. If engine knock continues then the engine has either too much turbo boost with too low octane fuel, or too much ignition timing programmed.

Proper location of the sensor and tuning of the KNOCK SENSE along with a proper KNOCK RETARD value are essential for satisfactory operation of this option. Knock control is not a magic bullet. **If the compression ratio or boost pressure is too high for the fuel octane you are using, either knock will occur or you will lose power by having to retard timing to prevent it. Constant hard knocking (detonation) will eventually destroy any engine, sometimes within seconds.**

KNOCK SENSE



This value is used to adjust the sensitivity of the knock sensor circuit. This is adjustable between 1 and 32, with 1 being least sensitive.
SDS supplied German and similar Japanese sensors will need a KNOCK SENSE value of between 20 and 32.
GM sensors mounted near the top of the engine block will need a KNOCK SENSE value of between 2 and 20.
Engine knock is most likely to occur around torque peak of the engine, which is usually from 3000 to 5000 on most engines, so sensitivity should be adjusted while in this rpm range.

<u>Adjusting:</u>
The knock sensor may also sense mechanical noise in the engine, so you will need to adjust the KNOCK SENSE carefully.

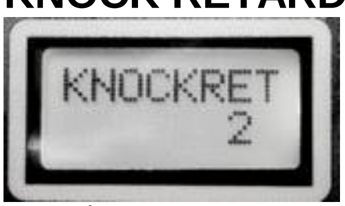
One method to adjust KNOCK SENSE is to start out with a high value, then rev the engine without any load, and watch IGN reading in gauge2 mode. If the degree symbol changes to show the letter K, then lower the KNOCK SENSE value. Keep lowering KNOCK SENSE and rev the engine until knock is not detected.

If KNOCK SENSE is too high then this may severely retard the timing when in fact no detonation is present. False triggering is more common at higher RPM’s. You can use KNOCK MAX RPM to help this problem

KNOCK MAX RPM

This disables the knock sensor above the RPM setting. This will prevent knock retard from occurring at higher RPM’s, typically above torque peak rpm on most engines, since at very high RPM’s, there may be a lot of engine noise picked up by the knock sensor. Leave at a really high setting if you don’t want knock disabled.

KNOCK RETARD



This value tells the CPi how much to retard the timing when a single knock event is sensed. A value of between 2 and 5 is recommended here.
Under normal engine running with no engine knock, there will be zero retard from the knock feature. When a knock event is sensed, the CPi subtracts the KNOCK RETARD amount from the total ignition timing.

Example:
Gauge screen shows IGN 30°.
KNOCK RETARD is 5.
If a knock event occurs, the Gauge screen would show 25K. (30-5). K indicates that a knock event occurred.

Usually when knock occurs there will be more than one knock event sensed, so the CPi will add up the multiple knock events. If you had for example, a 4 entered for KNOCK RETARD, then if 2 events were sensed, the CPi will have 8 degrees of knock ignition retard. If knock has stopped, then the CPi will slowly reduce the amount of knock ignition retard at a rate of approximately 2 degrees per second, until zero.

Testing the knock sensor
The engine does not need to be running.
Set KNOCK MAX RPM to 1000 or higher.
Set KNOCK SENSE to 10 for GM sensor, 30 for Japanese and German sensors.
Set KNOCK RETARD value to 3 or higher.
Display gauge2 mode in the programmer. Push the gauge button, then the > button.
Tap on the knock sensor lightly with a 10mm wrench.
You should see the IGN in gauge2 mode change and the letter K will appear after the 2 digits.

If the knock sensor is a 2 terminal style and is not working, try reversing the 2 wires to fix the problem. On some sensors you can identify which terminal is ground, by checking for continuity from the terminals to the metal sensor housing.

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 to test operation of CPi coil pack(s).
<u>4cylinder with single coil pack:</u> Pressing the PLUS button will cut out spark on the coil pack.

<u>4 cylinder using twin coil packs on 8 spark plug engines:</u> 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.

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

<u>Hidden settings</u>.

These can be accessed by <u>holding down the left arrow button when powering up the CPi unit</u>.
Plus and minus buttons are used to change the settings.

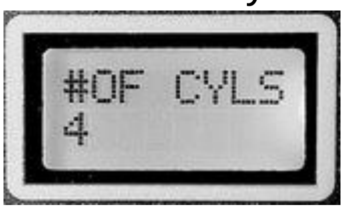
Map Type

22PSI will be the automotive setting. 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. If say 9750 is used, you can still rev higher, but the highest programmable range would be at 9750, so this timing value will be used beyond 9750, up to as high as you rev the engine. 15,000 should be selected if RPM IGN values need different programming above 9750 rpm.

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 setting is for engines with a distributor where the CPi unit is triggering just one ignition coil.

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 30% 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 engines 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.

Important! Wires which have caused interference problems in the past are Nology, Mallory and Taylor, so we do not recommend these. If you have these wires and are having problems try a different brand of wires. Ignition interference problems usually show up as strange characters in the programmer screen, rough running, misfiring or an RPM ERR code in gauge1 mode.

Will not start:

1. Check power and ground connections. Run power wires direct to battery.
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. Knock sensor picking up engine noise. Adjust KNOCK SENSE value.
2. If you don't have a knock sensor installed set KNOCK RETARD to zero and KNOCK SENSE to 1.
3. Keep knock(yellow) wire away from spark plug wires.
4. Magnets positioned incorrectly, so timing is retarded too much. Check timing with a timing light (non-knob or non-delay type). See MAG POS.
5. 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. Hall sensor bracket is vibrating. Improve bracket.
4. Interference from plug wires. Try a different brand of spark plug wires.
5. Make sure that all CPi sensor wiring and Hall sensor cable is not close to spark plug wires or any high current/voltage wires.
6. Check spark plug gap, possibly too large. Reduce to confirm.
7. Some German cars use resistor plug wire boots which can go open circuit. Measure resistance of the plug wire with boot attached, or remove the boot from the wire and check boot resistance, it should be around 5000 ohms, if it is in the hi 10,000's of ohms or greater replace the boot and plug wire.

Knock sensor not working:

1. Set KNOCK SENSE to the highest value.
2. Set KNOCK MAX RPM to 9000.
3. Test by hitting the sensor with a small wrench.
4. On two-wire sensors try reversing the wires.
5. Single wire knock sensors need chassis ground so make sure they make metal to metal contact.

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.