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## **WARNINGS AND CAUTIONS**

1. **DANGER!** The HPX generates high voltage that can be lethal. Do not ever touch a coil tower or spark plug wire when there is a chance of a spark.
2. Without the spark plug wires on the coils and spark plugs, the system will generate dangerous levels of voltage that can damage the HPX. This can also lead to fatal electrocution.
3. Do not let the spark plug wires touch the block, head, frame or body. The power of this ignition can burn through most spark plug wire insulation. Use a quality 8mm (or larger) wire with two piece spring loaded contacts and wire separators. Replace spark plugs wires every year (recommended).
4. Remove any series (ballast) resistance in both the +12 volt power (red) and the ground (black) wires. All connections must be clean and tight.
5. A fully charged battery is necessary for optimum performance of the system. During cranking, the battery voltage should not fall below 6 volts. If the battery is old, replace it.
6. Do not operate the standard HPX continuously at more than 18 volts. 24V units are available for special applications.
7. Double battery jump starts can damage the HPX.
8. Never disconnect the alternator while the engine is running. This may cause destructive high voltage spikes.

Electromotive technology is protected under U.S. patent RE 34,183 and others. Foreign patents also apply.

## **Your Electromotive HPX delivers more power because:**

- Spark timing is precisely controlled under all conditions, including rapid engine acceleration
- Crank trigger eliminates spark scatter due to gear lash and timing chain stretch
- Accurate spark timing allows sustained engine operation closer to peak power timing
- 100% spark energy to 9600 RPM on 6 cylinder and 12,000 RPM on 4 & 8 cylinder app's (at 12 volts)
- Operation up to 20,000 RPM (at higher battery voltage)
- Long, 2000 microsecond (typical) spark duration - 60° duration at 10,000 RPM!
- Built-in timing computer and rev limiter
- No power draining magnetos or distributors to drive
- No moving parts to wear out or replace
- Built-in timing monitor let you measure the advance with a voltmeter
- Options include: backup sensor, dual rev limiter, remote timing control

### **QUICK START GUIDE**

Carefully inspect all components and determine if any damage occurred in shipping. If damage is evident, contact the shipper for instructions to file a claim.

The installation procedure can be broken down into four simple tasks:

#### **1) Mounting the trigger wheel and sensor.**

If you purchased a bolt-on kit, refer to the instructions that were included with that kit. General trigger wheel information and installation instructions for the universal kits start on page 4. Instructions may also be downloaded at <http://www.electromotive-inc.com/>

#### **2) Mounting and wiring the control unit.**

Connect the Red wire to Battery +12V, Black to Battery ground, Grey to crank sensor. For more, see page 6.

#### **3) Tuning the spark curve.**

This is the most crucial step of the process. For maximum power, proper tuning techniques must be followed. For a complete rundown on the process, go to page 10.

#### **4) Installing any desired accessories.**

When you have the basics up and running, check out the enhancements that are available to increase overall performance. There is more potential than you might have imagined! Starts on page 14.

If you run into any problems after installation, skip to the **Troubleshooting** section for a list of possible fixes.

## TRIGGER WHEEL & SENSOR INSTALLATION

### BOLT ON KITS

#### Available for:

- » Chevrolet: Small-block V8, big-block V8, LT1/LT4, 90°V6
- » Chrysler: Neon
- » Ford: Small-block and big-block V8
- » Honda: 1.6, 1.7, 1.8, and 2.0 liter 4 cylinder DOHC VTEC
- » Volkswagen: Type 1
- » Jeep: 4.2L Inline 6



Many of our dealers offer bolt-on kits for the vehicles they specialize in, such as Porsche or Ferrari. Call Tech Support to find out if a kit is available for your application.

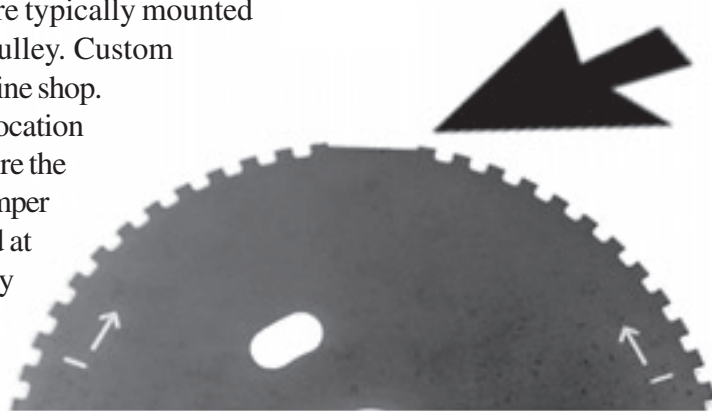
If you purchased a bolt-on kit, refer to the instructions for the kit. This section covers the universal kit and general installation principles. Electromotive ignitions have been fitted to virtually every type of engine made, so you can probably install it on your vehicle.

### TRIGGER WHEEL MOUNTING

The crankshaft position is measured using a toothed steel wheel and a position sensor. The standard "60 tooth" wheel has 58 teeth spaced 6° apart, and a "missing teeth" area 2 teeth wide that is used to detect the #1 cylinder. To properly identify #1, the sensor is installed so that, at TDC #1, the sensor is aligned with the trailing edge of the 11th tooth after the two missing teeth.

The trigger wheel is usually mounted to the front of the crankshaft. For coil-per-plug setups, a 60 tooth wheel is mounted to the camshaft. For installations where the crankshaft is inaccessible, a 120 tooth wheel is mounted to the cam. Because of belt/chain lash and cam twist, crankshaft mounting is preferred.

Crankshaft trigger wheels are available in 2½", 3½", 5", 6", 7¼" and 8¼" diameters; all are 0.125" thick. These wheels are typically mounted between the harmonic balancer and the first pulley. Custom installations may require the assistance of a machine shop. To choose the proper wheel size, find a suitable location on an accessible part of the crankshaft and measure the diameter of the largest part of the hub, vibration damper or pulley. The trigger wheel teeth must be spaced at least ½" away from other steel rotating parts as they will interfere with the sensor signal. Also find a prospective location where the sensor can be mounted securely, away from any motors or alternators.



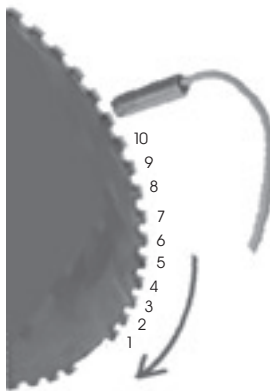
MISSING TEETH AREA  
("New Style" Wheel)

The trigger wheel must be mounted concentric with the crankshaft. One approach is to machine a shallow cut on the front or back face of the damper, and open up a matching hole on the inside of the trigger wheel. Then the wheel may be pinned or bolted in the proper location. Holes may also be drilled through the wheel to mount it between the damper and pulley. Remember that placing the trigger wheel behind a pulley will space the pulley(s) out 0.125", causing a slight offset on the belt.

The trigger wheel must not be out-of-round (see table for limits). If necessary, the entire damper/trigger wheel assembly can be trued on a lathe.



Universal Sensor Bracket



SENSOR ALIGNMENT

### SENSOR MOUNTING

For standard timing, the sensor must be aligned exactly at the trailing edge of the 11th tooth after the two missing teeth (where the mark is on the wheel). If some ignition advance is required for easier starting (high compression/radical cam timing engines, for example), aligning the sensor with the 12th or 13th tooth will yield 6° or 12° (respectively) of advance during cranking - NOTE: YOUR ELECTRONIC ADVANCE MUST REFLECT APPROPRIATELY LESS TIMING TO COMPENSATE FOR THIS. Also check that the sensor is centered over the edge of the wheel.

The sensor must not be near any stray magnetic fields generated by alternators or motors. The bracket must be mounted to something that does not move relative to the trigger wheel, preferably the block. The mounting must be rigid enough to resist vibration under all engine operating conditions. Once a suitable location is found, the universal bracket must be drilled on the blank end. Once the bracket is mounted, tighten the trigger wheel bolts and gap the magnetic sensor to the value shown in the table. Tighten the set screw for the magnetic sensor. Do not overtighten - it may damage the sensor. Use thread lock if loosening due to vibration is a problem.

Trigger Wheel Size	Air Gap (Wheel Style)		Allowable Out-of-round
	Old	New	
2½"	~0.010	~0.025"	.002"
3½"	~0.012	~0.030"	.003"
5"	~0.020	~0.040"	.005"
6"	~0.026	~0.050"	.006"
7¼"	~0.030	~0.060"	.007"
8¼"	~0.036	~0.072"	.008"

Use ½" sensor only on 3½" or larger wheels (2½" wheel requires chisel point sensor)

## CONTROL UNIT MOUNTING

1. Mount the HPX away from high temperature exhaust, road debris, or direct water spray.
2. Make sure the baseplate is not bent or stressed.
3. The unit should never be submerged in mud or water.
4. Keep vibration and heat to a minimum for best durability.
5. Maintain easy access for changing calibrations.
6. Use 1/4" bolts to secure the HPX and use thread lock or self-locking nuts to keep secure.

## HPX WIRING

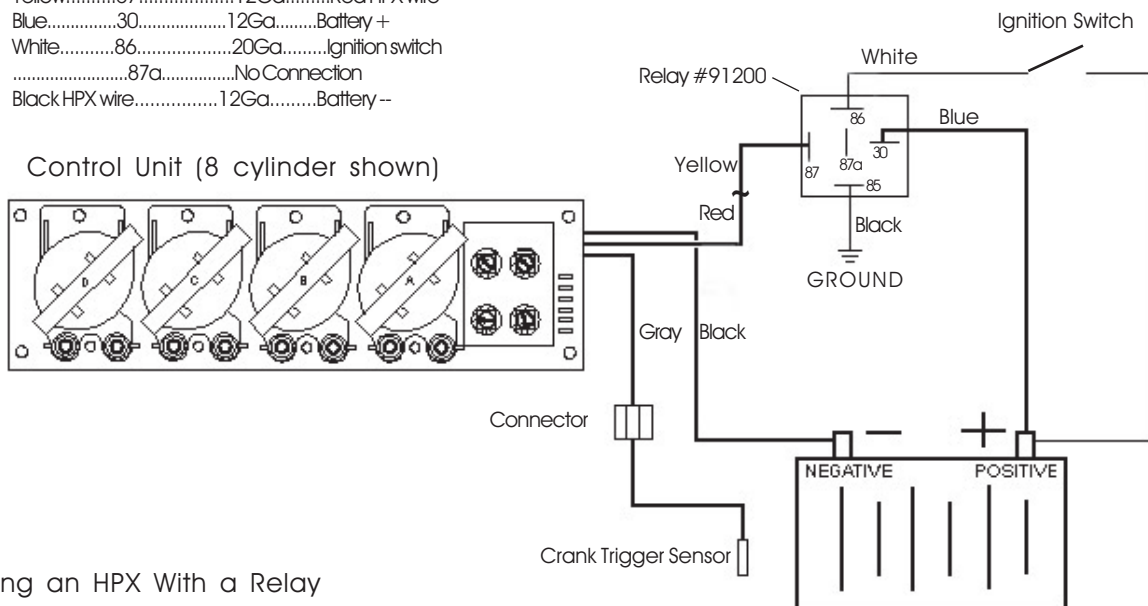
**CRITICAL Remove any series (ballast) resistors from the circuit. They are not needed and will cause the system to malfunction. Do not attach anything else to the HPX power supply circuit.**

**For vehicles that use fuel cutoff to stop the engine (most EFI engines):** There are only three HPX wires, so hookup is simple. For the maximum reliability, connect the Red power wire directly to the battery positive terminal, extending it with 12 gauge wire, if necessary. Connect the Black wire to the battery negative terminal in the same manner. Lastly, connect the Gray wire to the trigger wheel sensor. Battery drain when the engine is stopped is only 40mA and there are no switches, fuses, or relays to fail.

**For vehicles that must cut off the ignition to stop the engine or if zero battery drain is required:** To cut off the ignition, the Red power wire to the battery must be switched or relayed. Use a relay if the switch location would make the power wire more than 10 feet long. Use high quality 25A (minimum) switches and relays. Avoid putting the fuel pump or any other load on the same circuit as the HPX.

If you don't use an alternator, use a 16 volt battery. As a 12V battery discharges, the maximum RPM for full spark is reduced. With a higher voltage battery, the maximum RPM range is increased.

Wire	Relay Terminal	Size	Connection
Black	85	20Ga	Ground
Yellow	87	12Ga	Red HPX wire
Blue	30	12Ga	Battery +
White	86	20Ga	Ignition switch
	87a		No Connection
Black HPX wire		12Ga	Battery --



Wiring an HPX With a Relay

Fuse tip: Push-pull circuit breakers provide switching action plus circuit protection and are less prone to failure. They're a lot easier to fix when there's a problem, too! Use:

4 or 6 cylinder - 10 amp

8 cylinder - 20 amp

Example: e-t-a Type 41-3



## Grounds, Grounds, Grounds!

After connecting the HPX black wire to the battery negative post, make sure that the other required grounds are in place:

- » battery to engine block
- » battery to vehicle chassis
- » engine block to vehicle chassis

**NOTE: ALWAYS MAKE SURE THE COIL SCREWS ARE TIGHT.**

Use the **GND** tab ONLY for connecting HPX accessories.

### Special Note On Dyno Installations

When powering the HPX from the dyno battery, make sure that the battery is in good shape and is being charged when the engine is running. Never use a charger without a battery. If you want to use a separate power source, use at least a 25A/13.8VDC (35A for dual plug units) regulated power supply (available at hobby or ham radio stores). To suppress noise, run a ground wire between the engine stand and earth ground like a water pipe. Avoid long wires to the control panel and back to the engine. Don't use the HPX case as a ground for other devices, like the starter.

### CRANK TRIGGER Sensor

Be sure to secure its cable and connector to keep it from breaking or fraying. Keep the sensor wire away from high current and high voltage sources, such as the spark plug wires or the alternator.

### SPARK PLUGS

Since the HPX puts out significantly more spark energy than most other ignitions, a colder heat range plug can often be used. Use this spark plug gap guide:

Stock Street	0.045-0.060"
High Performance Street	0.030-0.035"
Alcohol High Compression	0.025"
High Power 75 to 115 HP per Cylinder	0.025"
Over 115 HP per cylinder, compression over 12:1, boost over 14 PSI	0.022"

If you want to try larger gaps, do it on a dyno where you can measure the power change. Increase the gap only as long as power increases. Then use the smallest gap that gives the best power, because the voltage requirement will increase as the plugs age. Large gaps decrease plug life, so make the best compromise.

## Spark Plug Wires

Use 8 mm or larger RFI and EMI suppression wire with late model GM boots. We recommend using a CARBON CORE suppression wire with 3K to 5K ohms resistance per foot and many of the *Spiral Core* wires will perform well. Resistive spark plug boots also may help misfiring problems. **SOLID CORE PLUG WIRES CANNOT BE USED.** If you are not sure about the suppression qualities of a particular wire, do not use them. Periodically check the plug end boots for carbon tracking. This can be done by looking at the plugs running in a dark area and spraying the spark plug wires with a spray bottle of water. Replacement of plug wires on an annual basis is recommended.

## Firing Order

Each HPX coil fires two spark plugs. Determine your engine's firing order, then install the plug wires.

The coils fire in the following sequence:

4 cylinder: A-B-A-B

6 cylinder: A-B-C-A-B-C

8 cylinder: A-C-B-D-A-C-B-D

Place the #1 cylinder plug wire on coil A, the next cylinder in the firing order on coil B, etc. Here are many of the popular firing orders:

Engine:	Firing Order	Coil	A	B	C	D
<b><u>8 Cylinder</u></b>						
Most GM, Chrysler and AMC	1-8-4-3-6-5-7-2	1&6	4&7	5&8	2&3	
LS1-style GM	1-8-7-2-6-5-4-3	1&6	5&8	4&7	2&3	
Ford 302, 355, 390, 429, 460	1-5-4-2-6-3-7-8	1&6	4&7	3&5	2&8	
Ford 351, 400, Porsche 928	1-3-7-2-6-5-4-8	1&6	4&7	3&5	2&8	
Cadillac 368, 425, 472, 500	1-5-6-3-4-2-7-8	1&4	6&7	2&5	3&8	
Mercedes-Benz	1-5-4-8-6-3-7-2	1&6	4&7	3&5	2&8	

## **6 Cylinder**

Buick 3.0L, 3.8L, Chevy 4.3L	1-6-5-4-3-2	1&4	3&6	2&5		
Chevy 2.8L	1-2-3-4-5-6	1&4	2&5	3&6		
Ford 2.8L	1-4-2-5-3-6	1&5	3&4	2&6		
Volkswagen VR6 2.8L	1-5-3-6-2-4	1&6	5&2	3&4		
Porsche 911	1-6-2-4-3-5	1&4	3&6	2&5		

## **4 Cylinder**

Most	1-3-4-2	1&4	2&3			
VW Air Cooled	1-4-3-2	1&3	2&4			
Dual Plug 4 cylinder	1-3-4-2	1&4	2&3	1&4	2&3	

Remember that most manufacturers have their own special cylinder numbering system.



Examples:

BMW 6 cylinder firing order    1    5    3    6    2    4

HPX 6 cylinder coil order    A    B    C    A    B    C

Mercedes Benz V8    1    5    4    8    6    3    7    2

HPX 8 cylinder coil order    A    B    C    D    A    B    C    D

## Spark Plug Wiring Worksheet

4 cylinder:

Firing order    \_\_\_\_\_

Coil            A    B    A    B

6 cylinder:

Firing order    \_\_\_\_\_

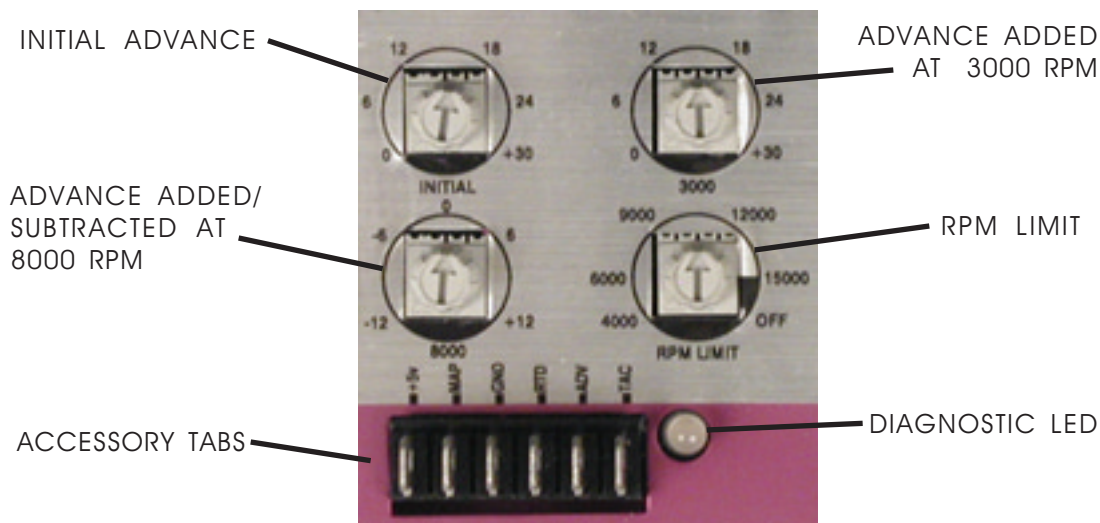
Coil            A    B    C    A    B    C

8 cylinder:

Firing order    \_\_\_\_\_

Coil            A    C    B    D    A    C    B    D

The basic mechanical and electrical installation is now complete.



**CONTROL PANEL**

### Diagnostic LED

The HPX control panel has an LED to indicate the operating mode:

On **power-up**, the LED will flash once, then turn steady Green.

When the engine is **cranking**, the LED will flash Red as long as it is receiving a signal from the crank trigger sensor.

During **normal running**, the LED will be solid Green.

When in **RPM LIMIT**, the LED will flash Orange.

### TABS for connecting accessories and meters

For operational and installation details, see the Accessories section.

**+5V** Supplies power for accessories

**MAP** Voltage-controlled timing advance input. Open = 5V = no advance added. 0V = 15 additional degrees. By connecting a MAP sensor, timing will be added according to the load indicated by manifold pressure. Less load, more advance. More load, less advance. Works with 1, 2, and 3 bar sensors.

**GND** Electrical ground for accessories only

**RTD** 1) Voltage-controlled retard control. Open = 0 volts = no retard. 5V = 30 degrees retard.  
 2) Backup sensor control. When **RTD** = 5V, it retards the whole advance curve by 5 teeth on the trigger wheel. By locating a backup sensor 5 teeth ahead (advanced) of the normal sensor, a DPDT switch can be used to switch trigger sensors and signal the RTD input to adjust the timing.

**ADV** 1) Advance output. See next section - Measuring Ignition Advance with a Digital Voltmeter.

2) RPM LIMIT input. If +5V is connected to the **ADV** tab, the current RPM becomes the RPM LIMIT until the +5V is removed. This can be used as a quickie limiter for staging or burnouts. If the connection is made when RPM is less than 4000, the RPM LIMIT is 4000.

**TAC** Tachometer connection. Sometimes a Tach Adapter is needed (see ACCESSORIES).

## CALIBRATION KNOBS

Four knobs are located under the screw-on cover - INITIAL, 3000, 8000, and RPM LIMIT. The first three are used to form the advance curve. (See next section.)

## SPARK ADVANCE CALIBRATION

### Measuring Ignition Advance With A Digital Voltmeter

HPX ignition advance can be read with a digital voltmeter. Connect the - lead of the voltmeter to the **GND** tab and the + lead to the **ADV** tab. Select the lowest DC voltage scale on your meter that will measure 0.6 Volts DC. The advance can be read directly from the voltmeter by multiplying the reading by 100. For example: 0.01 volts = 1 Degree, 0.30 volts = 30 Degrees.

### Trigger Wheel Position

99% of all HPX applications use the trigger wheel in the standard position - Cylinder #1 at TDC and the crank trigger sensor aligned with the trailing edge of the 11th tooth after the missing teeth area.

Others may require more or less initial or overall advance. By advancing or retarding the trigger wheel on the crankshaft, additional advance or retard is achieved. Just remember to compensate for this change in the overall spark calculation, because the **ADV** readout will not reflect the change.

## Engine TUNING BASICS

**A timing light with built-in advance measurements may only be used to verify "0" (no advance) due to the double pulse of the Electromotive ignition.**

**All timing measurements must be made relative to timing marks on a balancer or pulley, not the crank trigger wheel. If the crank wheel is not indexed to TDC, all timing measurements will be offset.**

Before starting the tuning process, you should collect some basic information:

- Measure the mechanical timing at the sensor
- Get target idle timing from a stock or comparable engine
- Get recommended maximum advance from your engine builder or other source

This information will give you a place to start. Real world testing will allow you to refine your curve for maximum performance.

### Measuring the Mechanical Timing

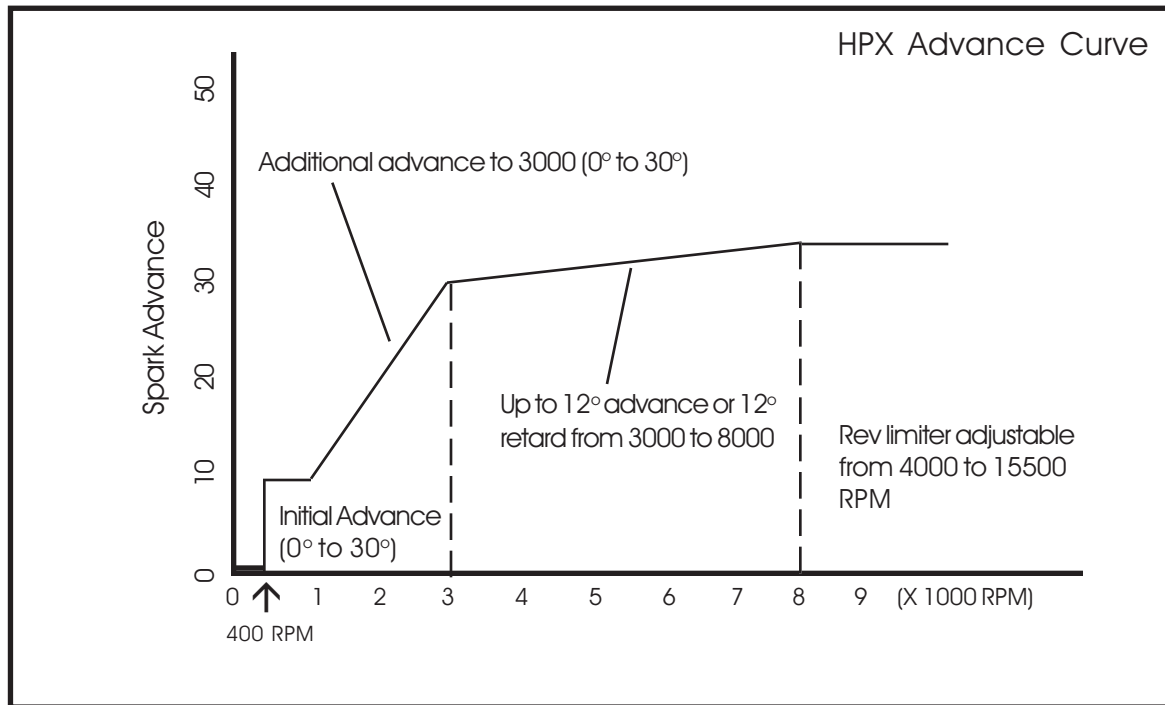
**Do not let your engine idle at zero timing any longer than required.** Set all three timing knobs to zero. Start the engine and attach your timing light to one of the COIL A sparkplug wires. Observe the engine timing; ideally it should be zero. If you have provisions for adjustments to your crank trigger assembly, adjust the sensor until there is zero advance. If you do not have the ability or provisions to eliminate any mechanical timing, or if you have intentionally built in some advance to help the engine start, write down the amount of timing displayed by the timing light. Always add it in when calculating total advance.

The Mechanical Timing Is: \_\_\_\_\_ Date: \_\_\_\_\_ Measured By: \_\_\_\_\_

## SPARK ADVANCE CURVES

The actual spark advance is controlled by different factors at different times:

Engine RPM	Spark Advance Controlled by
Cranking to 400 RPM	Crank trigger sensor and wheel ("Mechanical advance")
400 to 1000 RPM	INITIAL knob
1000 to 3000 RPM	Rises linearly from INITIAL to INITIAL plus 3000 knob
3000 RPM	INITIAL knob plus the 3000 knob
3000 to 8000 RPM	Rises or falls linearly by the 8000 RPM knob value
8000 RPM	INITIAL plus 3000 knob plus 8000 knob
Above 8000 RPM	Same as at 8000 RPM



### SETTING THE ADVANCE (ASSUMING ZERO "MECHANICAL" ADVANCE)

#### "INITIAL" Advance

The INITIAL knob sets the timing between 400 and 1000 RPM with a range of 0 to 30 degrees. If you are setting with a stock specification, make sure you have the actual advance the engine idles at. Don't confuse this with the service manual specification - which requires a disconnected vacuum line or an electrical connector to put the timing into some default mode. If possible, check a stock motor with a timing light when everything is hooked up. If no spec is known, try 10°-12° as a first test.

#### "3000" RPM Advance

This represents the additional spark advance added to the INITIAL when the engine reaches 3000 RPM. This value is added linearly from 1000 RPM to 3000 RPM. The adjustment range is 0 to 30 degrees. If no spec is known, try 21° for a full race engine or 24° for street stock engine.

## "8000" RPM Advance/Retard

At 8000 RPM you can add or subtract up to 12 degrees of timing from the advance you selected at 3000 RPM. This value is added or subtracted proportionately from 3000 RPM to its full amount at 8000 RPM. (Try -2°).

**WARNING:** DUE TO VARIATIONS IN PRINTING AND ASSEMBLY, THE KNOB DIALS MAY NOT EXACTLY INDICATE THE ACTUAL VALUES. ALWAYS USE A TIMING LIGHT TO VERIFY YOUR SETTINGS.

Suggested starting calibrations:

Street Stock: 0° Mechanical, 12° INITIAL, 24° "3000", -2° "8000"

Race Engine (Gas): 0° Mechanical, 12° INITIAL, 21° "3000", -2° "8000"

**CAUTION:** THESE ARE SUGGESTIONS ONLY! YOUR ENGINE MAY REQUIRE MORE OR LESS TIMING. IF YOU ARE RUNNING A HIGH COMPRESSION OR A BOOSTED ENGINE, START WITH LESS TIMING. ALWAYS START WITH LESS TIMING THAN YOU NEED AND INCREASE SLOWLY. IF YOU HEAR DETONATION, BACK OFF IMMEDIATELY!. DETONATION (CAUSED BY TOO MUCH TIMING ADVANCE) WILL DAMAGE YOUR ENGINE!

## "RPM LIMIT"

The HPX has a 3-stage RPM limiter for smooth, safe performance. When engine RPM reaches the first stage, timing is retarded to keep RPM from increasing, while preventing unburned fuel from collecting. If the RPM does increase, the second stage will decrease the coil current, further impairing RPM increase. The final stage is complete coil cutoff. This is the RPM above which the ignition will not operate.

**The RPM limiter range is 4000 to 15,500 RPM. Settings above 15,500 turn the limiter OFF.**

Most RPM limiters feel like hitting a brick wall. The engine cuts off violently and recovers slowly. The HPX's "progressive" RPM limiter feels gentler and generates less sudden power changes in the engine, reducing stress. You may even hit the first or second stage without realizing it, only noticing that the car stops accelerating and the engine feels "soft". If this RPM is in your normal operating range, you probably want to raise the RPM limit. For multiple RPM limiter settings, visit the ACCESSORIES section.

## FINAL CHECKLIST

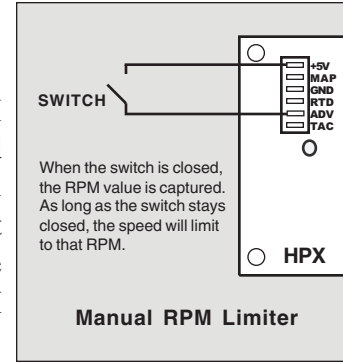
After you have set a calibration for your engine, review the check list below before starting the engine for the first time:

- the protective cover over the control knobs has been reinstalled
- sparkplug wires are RFI suppression type and attached in the correct firing order
- all ground connections are in place
- the HPX has a good +12V supply and all series (ballast) resistors have been removed
- the battery is in good condition, fully charged and reading over 12 volts
- the crank trigger wheel is running true and timed correctly
- the magnetic sensor is gapped properly and its cable connector is connected
- all bolts and screws have been torqued and locked down

## ACCESSORIES

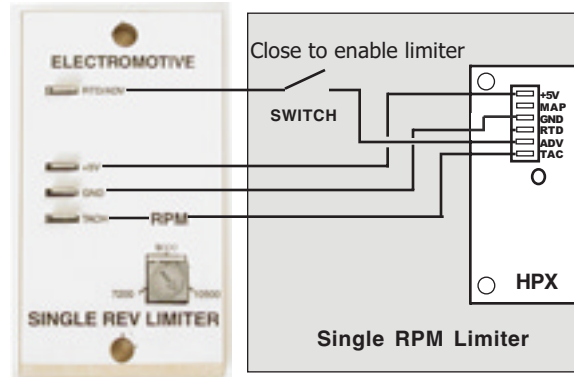
### MANUAL external REV LIMITER

Every HPX has built-in RPM limiter functions. You can make a quickie external RPM limiter by connecting a pushbutton switch (normally open) between the +5V tab and the ADV tab! First, set the RPM LIMIT knob for the normal RPM limit. Then you can bring the engine speed up to any RPM, press the button, and the engine will not exceed that RPM, even if you have your foot to the floor. When you release the button, the engine will accelerate, while enjoying the protection of the normal RPM limit setting.



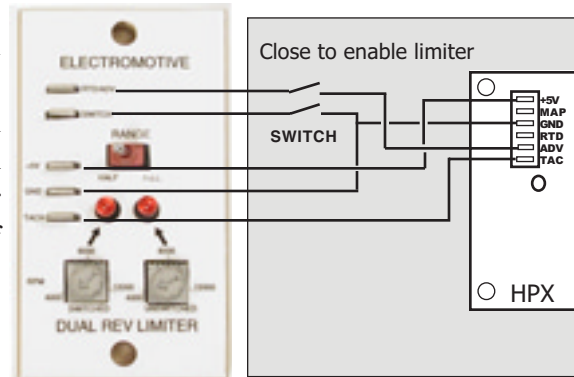
### SINGLE Rev Limiter

The Single Rev Limiter has one automatic RPM limit. It can be used with the internal RPM limiter to make a 2-stage limiter. (Refer to the wiring diagram at right.) When the switch is closed, both limiters are active (lowest one wins). When the switch is open, only the internal limiter is active. First set and test both rev limiters. Then close the switch when staging and floor the throttle. When the light goes green, flip the switch off and drop the clutch!



### Dual Rev Limiter

The Dual Rev Limiter has two automatic RPM limits. An external switch selects which limit is used. The external switch connects between the SWITCH and GND terminals. An onboard switch is provided that allows you to temporarily divide the rev limit speed in half. This feature allows you to set your rev limiters at safer engine RPM. Turn it back to "full" in order to take it out of half mode. An Enable switch turns this system into a 3-stage limiter.



### Notes on REV LIMITERS

Each rev limiter is specifically calibrated for a 4, 6, or 8 cylinder engine as noted at the end of the serial number on the limiter.

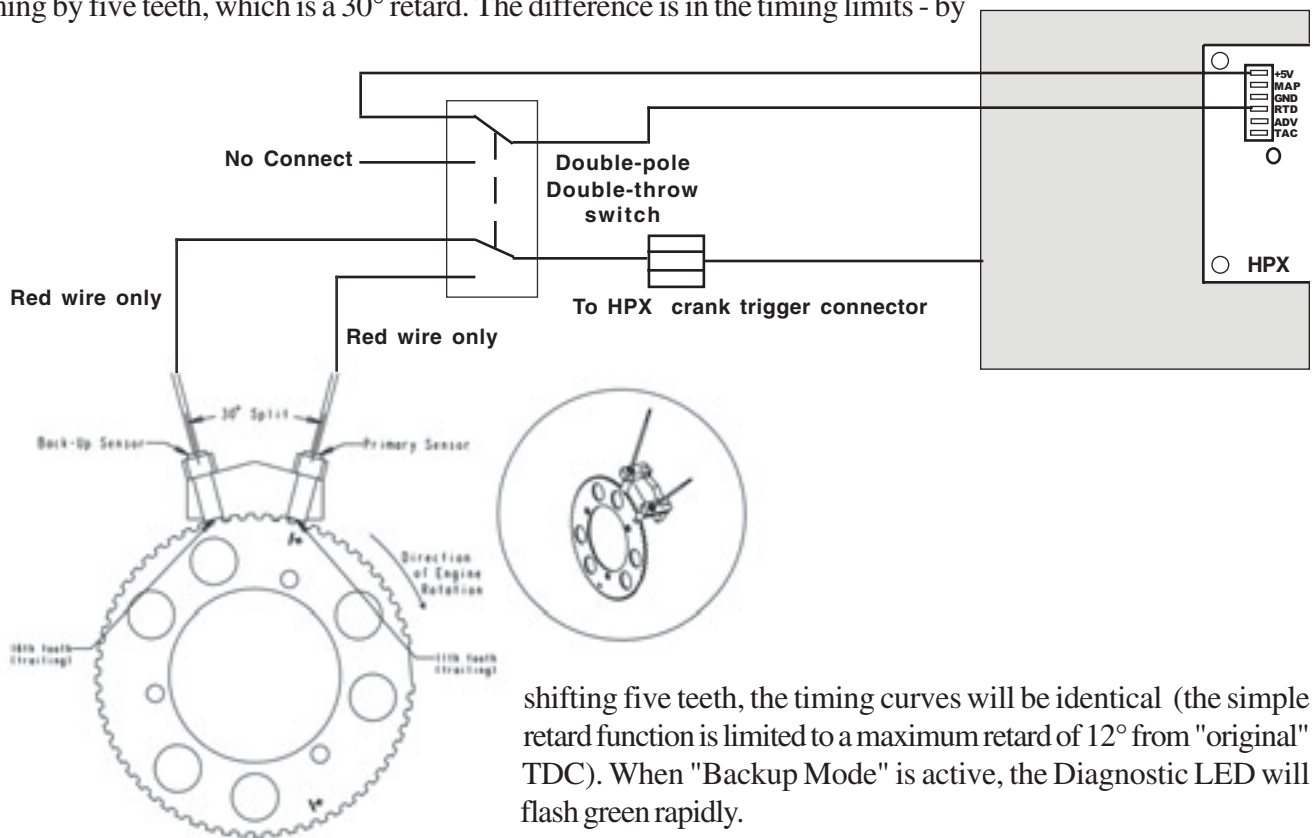
More than one limiter can be used on a single engine. Each works independently and can be switched in sequence. A different limiter could be engaged for each gear, for example.

Make sure that the limit you set is tested under load, as the engine will start to feel "soft" before the hard rev limit is reached.

### BACKUP CRANK TRIGGER SENSOR

An exciting new feature is a backup crank trigger sensor. By wiring up a DPDT toggle switch, you can switch between two different crank trigger sensors and maintain exactly the same timing. It is recommended that switching only be performed when the engine is not running.

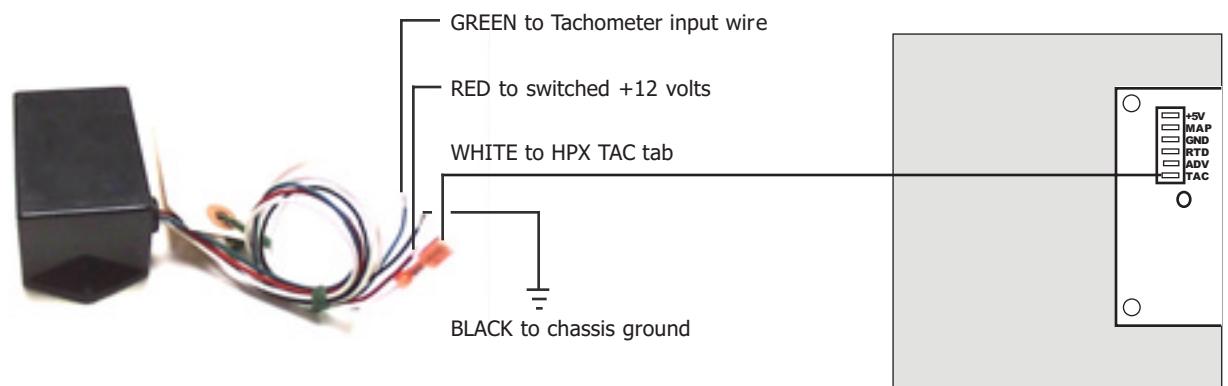
The backup sensor must be advanced 30° from the primary sensor. On one pole of the switch the two red wires of the sensor cables are selected. Since the sensor cable is shielded, expose as little as possible. The other pole of the switch is a signal to the HPX to shift all timing exactly five teeth retarded. The **RTD** tab is dual-function: from 0 to 4.86 volts, it is a linear voltage-controlled retard input. Above 4.86 volts, it shifts timing by five teeth, which is a 30° retard. The difference is in the timing limits - by



## Tach Amplifier

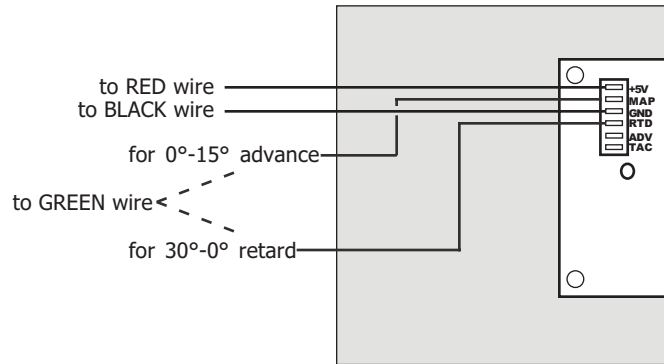
Most modern tachometers are designed to run on a 12 volt square wave, the signal the HPX puts out. Older tachometers work on a high voltage signal from the C- lead of the coil. The Tach Amplifier boosts the HPX's 12 volt signal to spikes of over 175 volts to allow compatibility with these older style tachometers. In many cases, a new tachometer or new internal components may be preferable to using the amplifier. Install the amplifier as close to the tachometer as possible.

Note: The amplifier may cause noise in your car's radio.



## REMOTE ADVANCE/RETARD CONTROL

The Remote Timing Control allows you to offset the overall timing curve from your dashboard or dyno console. Connect:



## TIMING ADJUSTMENTS

For advance control: Connect the green wire to the MAP terminal. Range of adjustment is 0 to +15° advance. Adjustment scale reads normally.

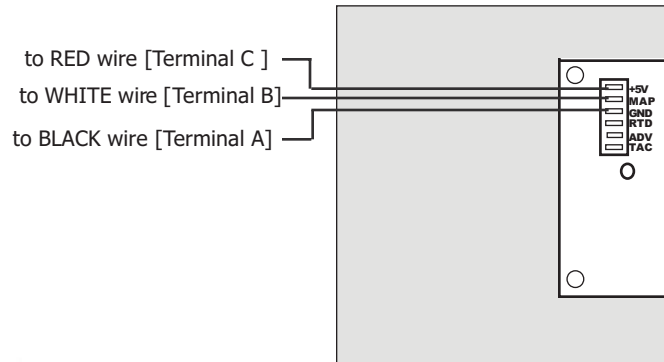
Maximum advance, with all factors added, is 60° before TDC.

For retard control: Connect the green wire to the RTD terminal. Range of adjustment is 30° to 0° retard.

Adjustment scale is 0° retard at the top and 30° at the bottom.

Maximum retard, with all factors added in, is 12° after TDC.

Note: Above 29° retard, timing switches to a real 30°, even if it was limited at 29°. See Backup Sensor section.



## DIRECT-CONNECT "VACUUM ADVANCE" UNIT

This "Vacuum Advance" adjusts the timing based on the load on the engine. It improves engine response over the entire operating range and brings timing closer to optimum.

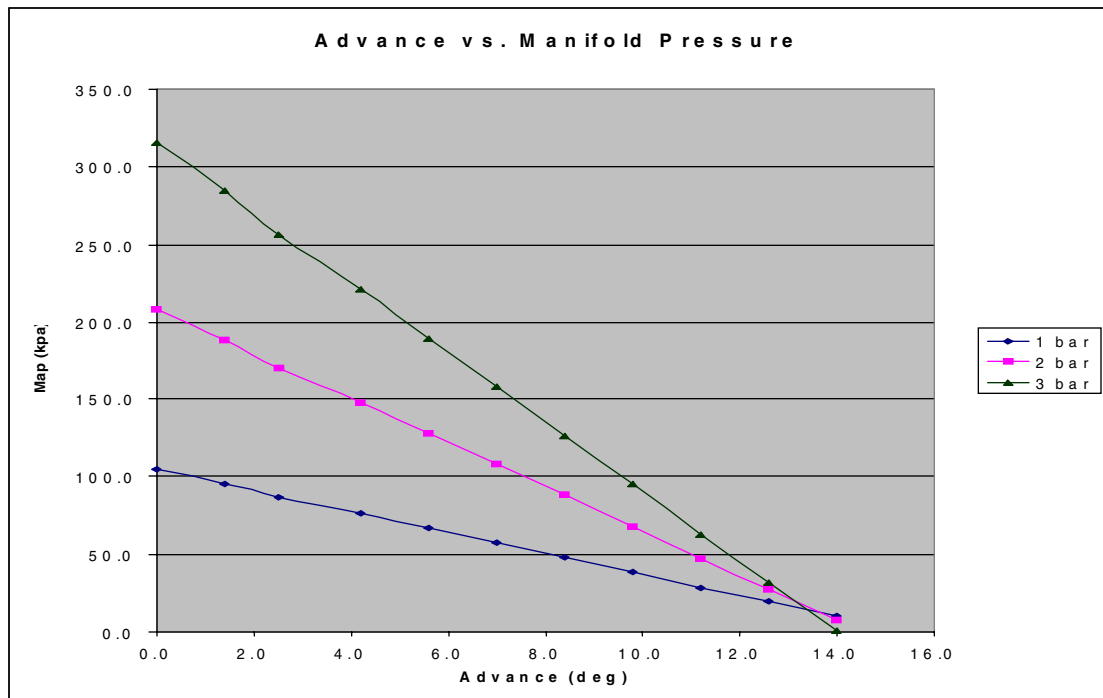
The Manifold Absolute Pressure (MAP) Sensor hooks up directly to the HPX's +5V, GND and MAP terminals, giving 15° of advance when the engine makes 30" of vacuum. This advance is in addition to the knob selected timing.

At idle, vacuum is high (manifold pressure is low), and the engine wants more advance, since cylinder pressures are low, too. When at wide open throttle, vacuum is low (manifold pressure is high) and no additional timing is added. See graph below for advance vs. manifold vacuum.

Different MAP sensors will give different advance curves (See graph next page).

You should retune your timing curve after adding a MAP sensor.



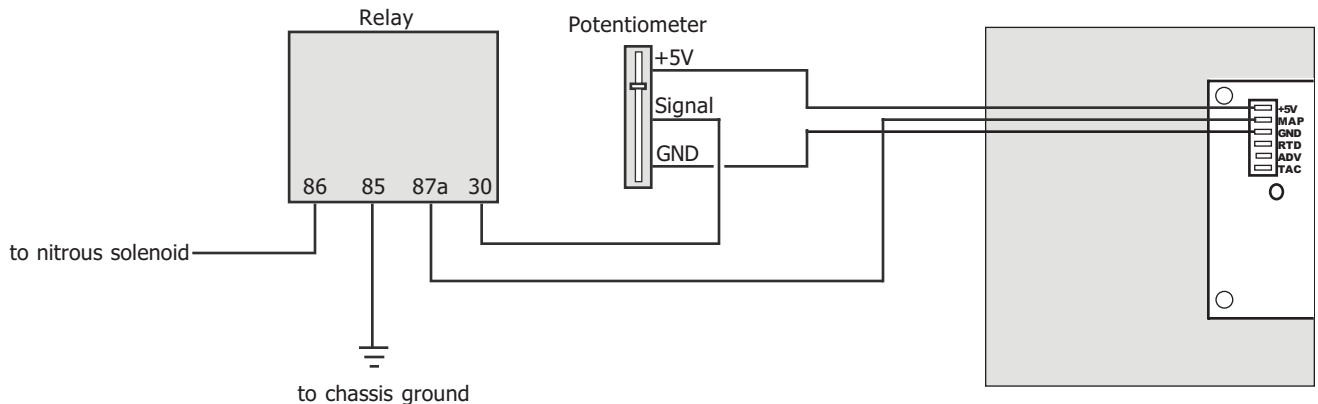


### Nitrous Oxide Timing Compensation APPLICATION NOTE (not a kit)

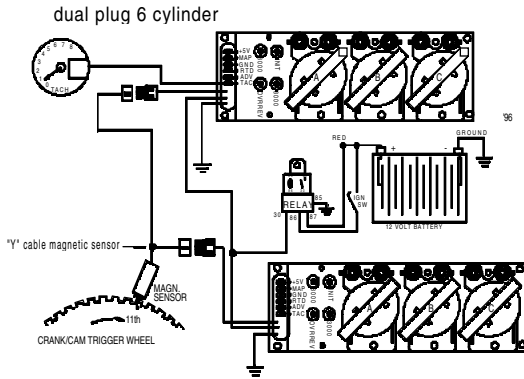
In a nitrous engine, the fuel burns faster when the nitrous is spraying. To compensate, the ignition timing needs to be retarded to prevent destructive detonation.

You can hook up a relay to switch between normal and nitrous timing. The relay is controlled by the same signal that activates the nitrous solenoid, as shown in the diagram below.

Set the timing knobs for the "on the bottle" advance curve. When the nitrous is off, timing is added using the MAP tab. Use the potentiometer to set the amount of timing added when the nitrous is off. The potentiometer voltage controls the additional advance from 0° at 0 volts to 15° at 5 volts.



## SPECIAL NOTES ON OTHER ENGINE CONFIGURATIONS

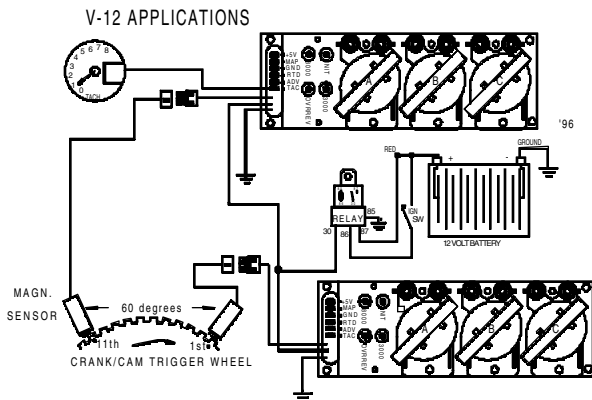
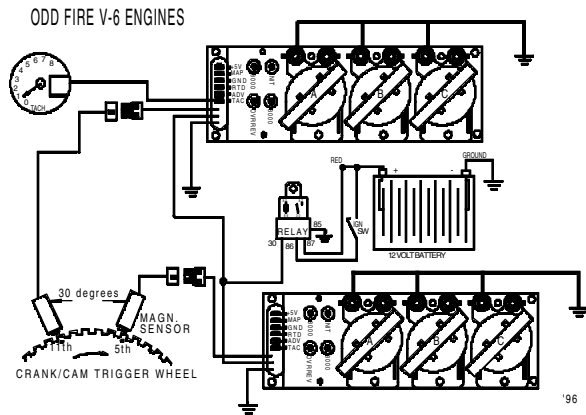


### Dual Plug Engines

Two HPXs can be applied to an engine equipped with two spark plugs per cylinder. Using a "Y" cable crank sensor, the same TDC and RPM inputs are supplied to both ignitions from the same trigger wheel. The spark timing of the two ignitions can be adjusted separately (rotary engines, for example) or fire simultaneously.

### Odd-FIRE 6 CYLINDER ENGINES

Use two HPX 6 Cylinder units with a common trigger wheel and two sensors spaced 30° apart. The engine is treated as two even-fire 3 cylinder engines. A special grounding harness shorts one of each coil's towers to ground, creating 6 single tower coils.



### 12 Cylinder Engines

Using two 6 cylinder HPXs and a single crankshaft trigger wheel, the respective sensors are placed the same distance, in degrees, from each other as the two banks are separated. On a 60° V-12, the sensors would be placed 60° apart. One unit handles the left bank and the other the right.

### Two Cycle Engines

Two cycle engines can be handled with one HPX for 1 through 4 cylinder applications. A 4 cylinder HPX would be used for a 2 cylinder 2 cycle engine since its coils fire every 180°, and a 6 cylinder HPX for a 3 cylinder since it fires a coil every 120°. A normal 60 - 2 wheel would be used on the crankshaft. Since only 2 tower ignition coils are available, one of the two towers must be shorted to engine block ground to complete the spark circuit. If dual plug heads are available, both plugs may be fired from the same coil but the combined air gap cannot exceed .060". Special note: Since most 2 cycle engines have magneto-type flywheels, it is absolutely necessary that all residual magnetism be removed from the crankshaft. Remove the permanent magnets and demagnetize the flywheel and crankshaft before installing the system.

## TROUBLESHOOTING GUIDE

When in doubt, read the instructions! Before starting, make sure that the engine is in proper mechanical order.

### Engine cranks but won't start or fire

Begin troubleshooting with the ignition switch OFF. Locate the Diagnostic LED on the HPX.

Step 1: While looking at the LED, turn on the ignition switch. The LED should flash, then go steady green.

If the LED does not go on, there is a power or ground problem. If the LED goes on, but does not blink, there may be an HPX problem.

Step 2: Crank the engine and observe the LED, which should blink red while the engine is cranking.

If the LED doesn't blink, the HPX is not receiving a signal from the crank sensor. Inspect for physical damage caused by the trigger wheel. Check the air gap between the sensor tip and wheel. Try smaller air gaps. Make sure the bracket and nearby parts are not magnetic or magnetized. (Magnetic sensor only) Replace the crank sensor if the resistance between the red and black wires going into the sensor is outside the 600 to 800 ohm range.

Check: Supply voltage.

Verify that the cranking voltage at the HPX red wire does not fall below 8 volts and the black wire does not rise above 0 volts on.

Red Wire Key on - 12.0 to 18.0 Volts; Cranking - no less than 8 Volts

Black Wire 0.0 Volts under all conditions

Check: Spark.

The preferred method: Attach an inductive timing light to any sparkplug wire and crank the engine to see if the timing light strobos. Also, look for the tach needle to jump while cranking. Alternatively, use a sparkplug style tester and check for spark at the plug end of the wire while cranking. CAUTION: This is an extremely powerful ignition and may be lethal! DO NOT handle the spark plug wires or coils while the engine is running! STAY AWAY from all connections when cranking!

Check: Cranking RPM

Make sure that the engine is turning fast enough. For safety, HPX will not fire the coils if the RPM is less than 100 RPM.

### Engine backfires during cranking

Check: Incorrect mechanical advance. Either too much (for most engines) or not enough mechanical timing for high overlapped valve engines. Verify mechanical advance and adjust as necessary.

## Engine starts, but misfires or dies at high RPM

Check: Sparkplug wires.

The plug wires must be connected and in the correct firing order. Also check for shorts or burnt-through insulation. Wires over a year old should be replaced with new wires. Sparkplug wires must have a resistance of 3000-5000 ohms-per-foot or greater. Replace wires as necessary.

Check: Spark at each plug.

With an inductive crank trigger timing light, check every sparkplug wire to see that it strobos the light. Replace plugs and/or wires as necessary.

Check: Battery.

Check battery for age or obvious damage. Load test if possible. Check voltage under cranking and running conditions. Battery may have loose plates or internal connections.

In some applications with dual batteries it is not recommended to use diodes in the connection between the batteries, especially in the ground circuits. If electrical noise still tends to misfire the HPX, a large (220  $\mu$ F, 20 volt or higher) capacitor is recommended across the HPX's red and black power leads. Try to install the capacitor as close to the HPX as possible.

Check: The crank sensor and trigger wheel.

The sensor and trigger wheel must be installed accurately according the installation instructions. Check the mechanical timing, sensor-to-trigger wheel air gap and run-out, both radial and lateral. Look for damaged teeth on the wheel. Replace or machine as required to bring into spec. The sensor bracket must be sturdy enough to not vibrate at high speeds. Check the wiring of the magnetic sensor, including proximity to interference sources. Keep the sensor wire at least 4" from plug wires, alternator wires, or any other wires carrying high current.

Check: Calibration.

Too little or too much timing will cause running problems and potential engine damage. After measuring mechanical timing, use a voltmeter to verify advance reading. Dial back timing lights are not compatible with the extra spark of the HPX, so they will not show accurate timing information.

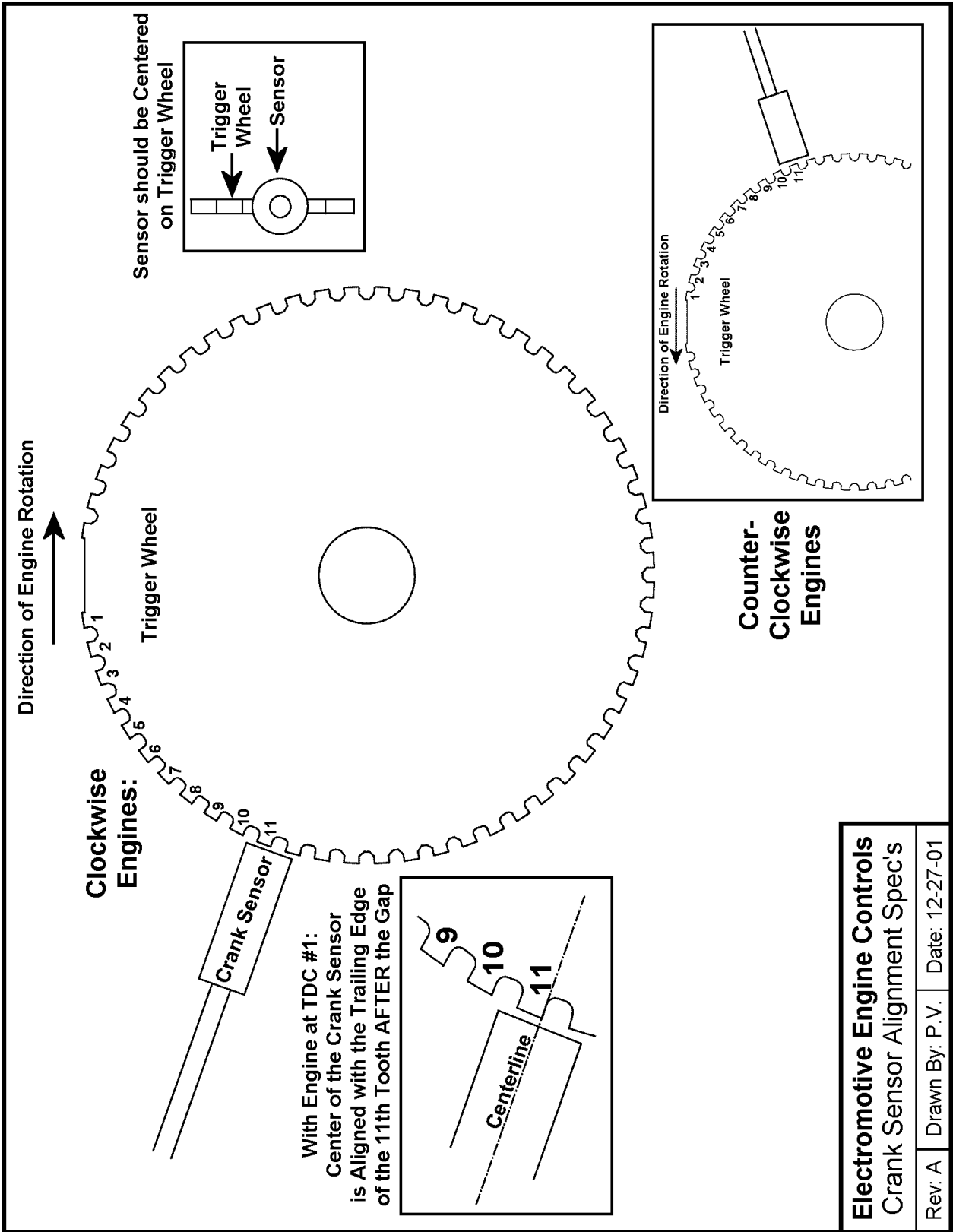
Note: One of the plug wires attached to a coil goes positive, the other goes negative. If your timing light does not flash correctly, change the pickup to the other wire on that coil. At steady RPM, the timing mark should be extremely stable.

Check: Coil hold down screws.

The screws holding the coil to the baseplate must be very tight. Check for corrosion. Clean, tighten as required.

Check: Fuel mixture.

Adjust as necessary.



# Terms and Conditions

## **DIRECT SALES AND OUR VALUE ADDED DEALERS**

Electromotive products are sold either direct or through our Value Added Dealers (VADs). Electromotive works closely with a network of independent dealers throughout the world. These dealers supplement our products with their experience, installation and calibration skills for specific applications. Combined with their discounts and expert knowledge, it can often be more effective to purchase a system from a VAD instead of directly from Electromotive.

## **WARRANTY**

### **1 Year limited warranty covers material and workmanship**

All warranty claims must be pre-approved by the factory. Please call for return authorization and instructions. Customer is responsible for the return of dysfunctional units to Electromotive. All units in need of warranty repair should be sent "Attention: Service Department" to the address shown below. The service department will repair or replace units at their discretion. A service charge will be assessed on units with no trouble found or units found to be damaged due to customer misuse.

## **Repairs & Returns**

An RMA number is required for all shipments to Electromotive. All units in need of repair should be sent to:

Electromotive, Inc.

Attention: Service Department

9131 Centreville Road

Manassas VA 20110-5208

Customer is responsible for all shipping charges. Include a short note outlining the problems encountered and how you can be contacted. Please be aware that a minimum service charge will be assessed for testing, even if no trouble is found. All returns require pre-approval by Electromotive and are subject to a 20% restocking charge.

## **Pricing Policies**

All prices subject to change. Wholesale pricing will be extended to automotive businesses only. A copy of the business license and a commercial phone listing are required. Discounts are based on quantity purchases or repeated purchases over 12 months. No discounts on individual orders under \$250.