

Converting the GM LS Engine to Carburetor Induction

Eliminating the fuel injection setup in favor of a good 'ol carb is easier than you may think.

BY MIKE MAVRIGIAN

Just because GM LS engines originally featured electronically controlled fuel injection, that doesn't mean that you're stuck with this setup. For many racers or street rodders who want to take advantage of LS engine performance but prefer a simplified "old school" fuel system, switching to a carb is a surprisingly easy task.

Now, there's nothing wrong with electronic fuel management, and I personally hate referring to carburetors as an "old school" element. But the fact is that many rodders and racers simply prefer to use a carburetor, either for the sake of appearance or to simplify the installation, or both (or because certain race sanctioning body rules dictate the use of carbs).

If you plan to use a carb instead of central or direct-port fuel injection, you also have a choice of ignition setups, which involves using either the eight individual coilpacks and a timing controller, or going to a front-mount distributor (with built-in HEI coil) and eliminating the eight coilpacks. Here, we'll address both carb approaches. Since I recently built an LS2 with a carb & coilpack setup, I'll refer to that specific build as an example.

CARB SETUP

If you prefer to run a carburetor, you have a choice of two formats. One option involves the use of a 4-barrel intake manifold, a carburetor, a distributor adapter and a distributor. A typical setup includes an Edelbrock Victor Jr. intake manifold P/N 29087 or the Super Victor Jr. intake manifold P/N 28097, a GM distributor adapter P/N 88958679, and Performance Distributors Ford smallblock (yes, Ford smallblock) distributor P/N

31820 and Performance Distributors plug wires P/N C9076. The GM adapter serves as both a timing cover (taking the place of the original cover) and features a housing that accepts a Ford smallblock distributor. A short camshaft stub with distributor gear (part of the adapter set) bolts to the existing camshaft, providing a means to drive the distributor.

Another (less expensive and more readily available) option uses the Edelbrock Victor Jr. or Super Victor Jr. intake manifold with the stock-type LS timing cover, no distributor, eight coilpacks and an MSD timing control module. The module uses signals from cam and crank timing sensors.

FYI: Other setups are also available. For example, a Victor Jr. intake manifold drilled to accept fuel injectors. Instead of a conventional carb, a downdraft throttle body is used to regulate intake air.

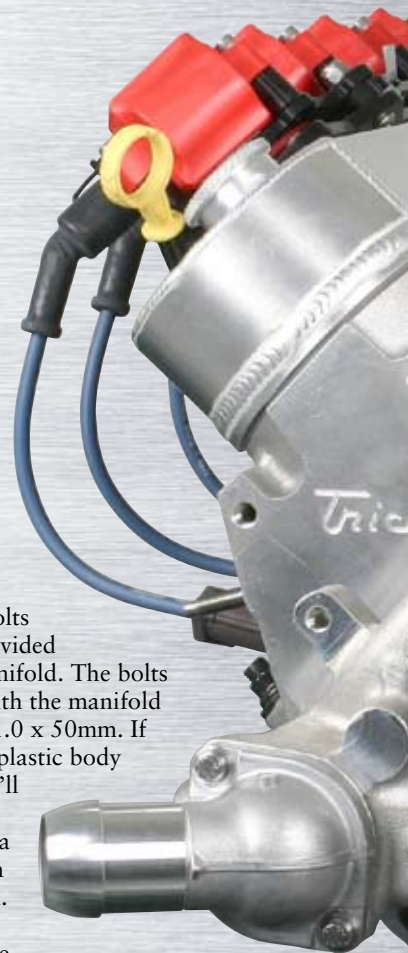
OUR INTAKE MANIFOLD

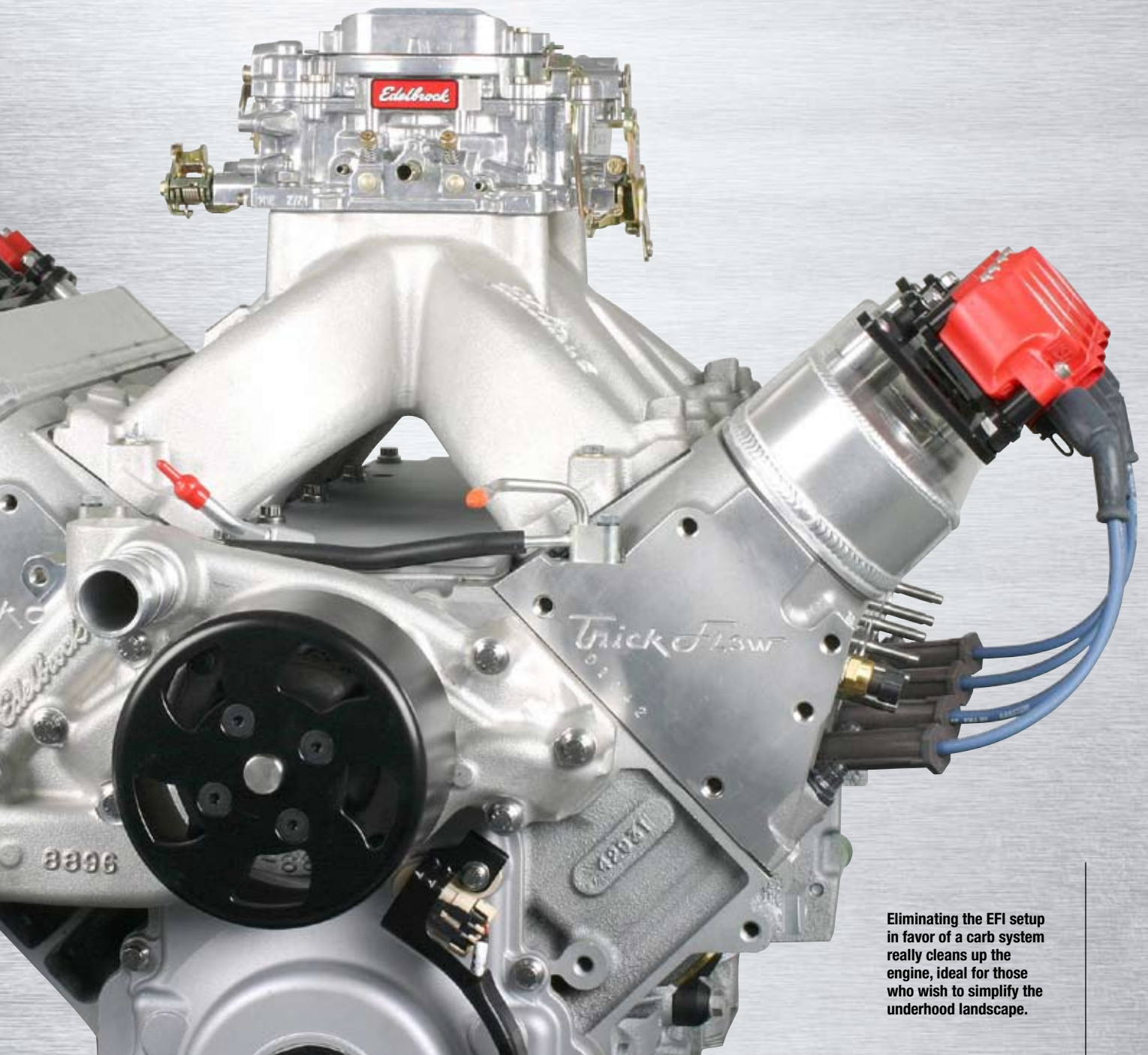
The Edelbrock Super Victor Jr. carbureted intake manifold P/N 28097 features an operating range of 3500 – 8000 rpm. This is a high-rise single plane intake, capable of supporting over 600 HP. This manifold accepts a square bore carb. The Super Victor offers greater air flow potential than previous LS manifolds. The carb mount pad is 1.12" taller than the Victor Jr. LS1, and the port exits have been increased to 1.08" x 2.74". This manifold has already been accepted by NASCAR for use in the Grand National division/Busch North spec engine series. Carb pad height is 6.07".

First, let's address mounting the carbureted intake manifold, citing the Edelbrock Super Victor Jr., P/N 28097. While you can use an OE plastic type intake manifold gasket set (the gasket

body measures 0.200" thick), you'll need longer mounting bolts than are provided with the manifold. The bolts packaged with the manifold are 6mm x 1.0 x 50mm. If you use the plastic body gaskets, you'll need bolts that feature a shank length of 55-60mm.

However, the Edelbrock instructions specifically tell you to use Fel Pro gaskets P/N 1312-3. These gaskets measure 0.063" thick. While the provided bolt length of 50mm is fine, I ran into an interference issue when using the thinner Fel Pro gaskets, between the bottom inboard surface of the intake runners and the engine's top valley cover plate. The runners hit the outer edge of the plate, preventing full mating of the manifold decks to the heads. The solution would be to either grind reliefs on the inboard bottom of the runners or to chamfer the edges of the valley plate. I opted for the latter. With the manifold mocked in place, I marked the cut areas on the valley cover for each of the eight cuts. I would have preferred simply chamfering the entire length of each side of the cover plate, but the chamfers would have then interfered with the manifold bolt washer footprints. Using a Bridgeport mill, we cut eight chamfer reliefs on the top edge of both the right and left sides of the valley plate.





Eliminating the EFI setup in favor of a carb system really cleans up the engine, ideal for those who wish to simplify the underhood landscape.

The cutting of the angle reliefs removed 0.193" from the horizontal surface and 0.190" from the vertical surface of the plate edges. Each of our mill chamfer cuts are about 2.280" long.

Note: in order to chuck the cover plate on the mill, the plastic PCV housing (mounted to the underside of the plate) must be removed. In addition to the 5mm bolts that secure this housing, the housing is gasketed to the plate with some tough RTV. If you try to pry it off, you'll break the plastic, so it must be separated with a thin scraper or a razor. Once the plate was machined and repainted, I reinstalled this plastic housing with Permatex "The Right Stuff"

black RTV to serve as the sealing bead.

Once this interference issue has been resolved (really no big deal), I torqued the intake manifold bolts to a value of 11 ft-lbs (per Edelbrock's instructions), following Edelbrock's bolt tightening sequence.

The Edelbrock Performer 4-barrel carb P/N 1412 was snugged to the intake (using ARP stainless steel carb studs and nuts) to 90 in-lbs.

OUR 4-BBL CARB

Edelbrock's recommendation for the carb choice is their Performer Series P/N 1412 (800 cfm, manual choke), recommended for displacements greater than 6.0L and/

or vehicles that will experience frequent track time. FYI: their recommendation for a 6.0L street driven application is the Performer Series 1407 (750cfm, manual choke) or 1411 (750 cfm, electric choke).

CONTROLLING CARB SETUP IGNITION (WITH COILPACKS)

Now for ignition control. In order to utilize a carb (with coilpacks and no distributor) on the LS, the MSD Timing Control P/N 6010 is required. The kit includes the ignition controller, Pro-Data+ software (on a mini CD), wiring harness and individual plug-in timing modules. Optional accessories include

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MSD's hand held monitor P/N 7550, and a wiring harness for intake manifold mounting (if you opt to mount the box on the intake).

Note: if you have a carburetor setup, you only need the MSD timing controller kit and the coilpacks, an OEM coilpack wiring harness, the crank sensor, cam sensor and optional MAP sensor. You do not need an ECU. If you're using this MSD timing controller with an EFI setup, then you do need to retain an ECU. So, you can use a carbureted LS engine in any vehicle (street rod, race car, etc.), with no need for a central ECU.

MSD's 6010 ignition controller is designed for GM Gen III engines that have been retro-fit with a carburetor and carb manifold. The controller can also be used in stock EFI applications by using harness P/N 8886.

The controller is supplied with a wiring harness that connects to the factory connectors. A shorter harness, mentioned above, is designed for mounting the controller on the intake manifold, under P/N 60101.

The MSD controller offers several programmable features that allow rpm and timing adjustments. This can be achieved by using the supplied Pro-Data+ software (and connecting a PC-type computer to the controller with the supplied PC harness), or with the optional MSD hand held programmer 7550.

Don't feel like messing around with re-programming? Timing curve selections



It may be necessary in some cases to notch the engine's valley cover for intake manifold runner clearance.

can also easily be made by using the supplied plug-in modules.

Note: MSD offers a controller for either the 24-tooth or 58-tooth LSD reluctor wheel. Be sure to specify which tooth count you're dealing with when ordering the MSD controller.

The controller kit is supplied with six timing curve modules (small 2-pin plug-ins) that plug into a port on the side of the controller. The modules are labeled Curve 1, Curve 2, etc. By using one of these modules, the timing curve will be set with a pre-programmed curve that was mapped out by the MSD engineers,

tailored for different camshafts, final drive gearing and vehicle weight.. So, you can plug in a curve module of your choice, or you can create your own custom program by using their software and a PC. Note: any updates that are made using the PC software will be overridden if a plug-in module is left plugged-in during power-up of the controller. So, if you plan to create your own program, don't leave a module plugged in.

The controller allows you to program two rev limits: one for an over-rev safety and another that provides

EDELBROCK REFERS TO THE TIMING CONTROL CURVE MODULES AS FOLLOWS:

CURVE 1: Stock or mild camshaft & heavy or low ratio gear

CURVE 2: Stock or mild camshaft & medium or standard gear

CURVE 3: This is the default curve. For stock or mild camshaft & light or high gear ratio

CURVE 4: Z06 or Edelbrock 2215 camshaft (some overlap) & medium or high ratio gear

CURVE 5: Z06 or Edelbrock 2215 camshaft (some overlap) & light w/standard ratio or high ratio gear

CURVE 6: High overlap cam such as Edelbrock 2216 & light w/high ratio gear

CURVE 1		CURVE 2		CURVE 3		CURVE 4		CURVE 5		CURVE 6	
RPM	DEG	RPM	DEG	RPM	DEG	RPM	DEG	RPM	DEG	RPM	DEG
0		0	12	0	12	0	15	0	15	0	22
1000	20	1000	22	500	20	1000	28	800	30	800	32
2000	26	1700	27	1700	28	2000	29	2000	32	4500	32
4200	33	4300	29	4300	29	4300	29	4200	34	6700	36
6000	35	6000	36	6000	36	6000	36	6000	36	3800	36
6100	35	6100	36	6100	36	6100	36	6100	36	6900	36

Note: Low ratio = approx. 3.20 – 3.50:1 Standard = approx. 3.40 – 3.73:1 High = approx. 3.90 – 4.11:1 or higher

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a low limit for use as a hole shot or two-step limit. The RevLo is the low rpm limit that is designed to be used while staging at the starting line. It is activated when the blue wire is connected to 12 volts. When 12 volts are not present on this wire, the High Rev Limit is active. It is adjustable in 100 rpm increments from 2,000 to 12,500 rpm.

The RevHi is the over-rev rpm limit. It is active whenever the blue wire (RevLo) is not connected to 12 volts. The RevHi is also adjustable from 2,000 to 12,500 rpm, in 100 rpm increments.

A step retard (Sw retard) will provide an adjustable amount of retard at a specific moment. This is ideal when using nitrous oxide injection. The amount of retard is adjustable from 0 to 15 degrees, in 1 degree increments. The retard is activated when the pink wire is switched to 12 volts. The default retard is 10 degrees.

The programmable instructions (included in the controller instruction booklet) are actually not that complicated. We won't discuss them here



While the conventional mounting location for the coilpacks is over the valve covers, keep in mind that this isn't written in stone. If you want to clean up the valve cover areas, simply relocate the coilpacks elsewhere under the hood, using longer plug wires and extending the harness wires.

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due to space constraints, but it's not as bad as you might initially fear. The MSD software walks you through it, and rest assured that you don't need to be a computer whiz to handle this. You can program the controller at your office desk (it connects to your PC via the supplied cable), or you can use a laptop computer while the engine is on the dyno or in the car. You can easily create your own custom timing curve (a really cool advance chart and timing map appears on the computer screen), and you can re-program any time you want. But remember: you don't absolutely have to create your own program. You can just plug in one of the curve modules and go. This is great, since MSD gives you a choice of using one of their six programs, or enabling you the option of custom mapping.

The controller instructions also clearly list the purpose of each harness wire. For example, on the 3-pin crankshaft sensor connection, the orange/yellow wire is for crank sensor signal; the brown wire is for sensor ground; and the pink wire is for the 12-volt supply. This makes troubleshooting easier, and allows you to make up a custom harness if you so desire. Wire identification is provided for the crankshaft sensor, camshaft sensor, optional MAP sensor and coil connectors (for each cylinder).

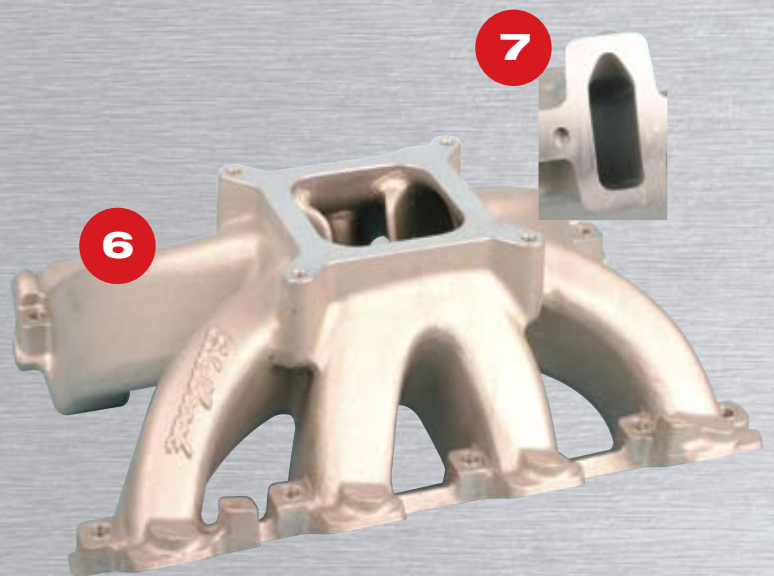
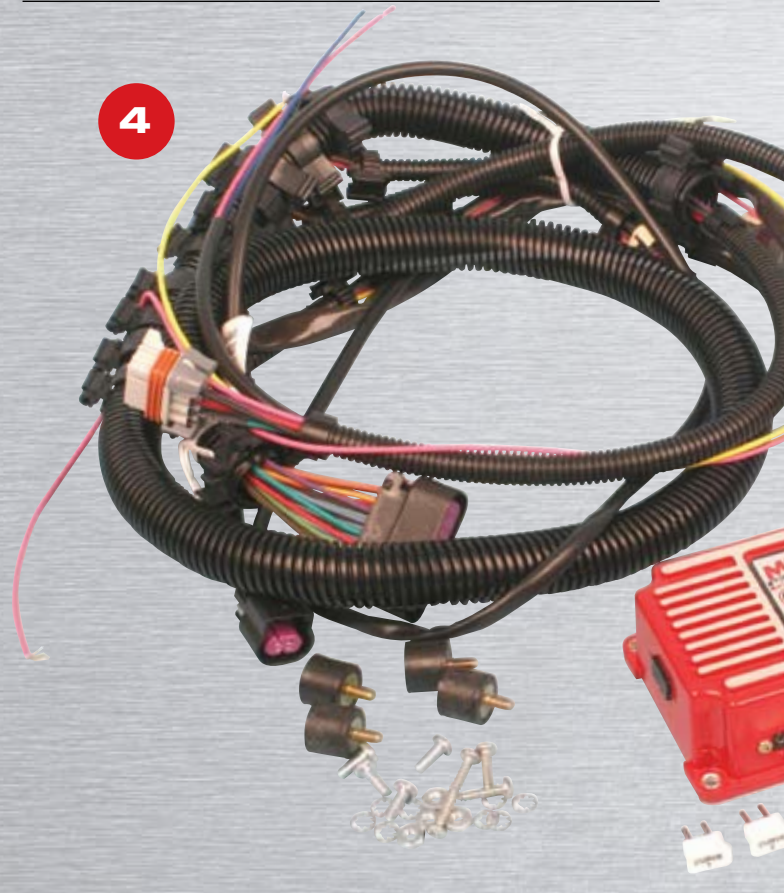
The MSD controller box may be mounted in any convenient location underhood (firewall, inner fender, etc.), as long as it's placed away from high heat sources; or it can be directly mounted to the right rear side of the intake manifold itself (MSD offers a mounting bracket for this purpose, as well as a short wiring harness). Or, for those of us who prefer to be different, it could be mounted in the vehicle interior.

Don't let the need for the "controller" and talk of laptop computer programming scare you off. MSD's controller is really easy to set up and use. Remember: you don't need to program the setup with a computer and their software if you don't want to. Just plug in the curve module that you select, and go. Plug & play.

CARB WITH DISTRIBUTOR (NO COILPACKS)

The next carb type setup involves the same intake manifold and carburetor, but with a twist: get rid of the eight individual coilpacks and mount a distributor at the front of the engine. GM Performance offers a distributor adapter kit, P/N 88958679 (actually made by Wegner). This includes a cast aluminum LS front distributor drive cover (this replaces the OE front cover), designed to accept a Ford smallblock distributor. The kit includes a stubby camshaft front extension that bolts to the existing cam, and provides a drive gear for the distributor.

As but one example, Performance Distributors offers a way-cool Ford smallblock distributor, already fitted with an HEI coil. Remove the OE front cover, install the GM cam adapter and cover, drop the distributor in, set your timing and go. No computer, no timing module...just a carb and an electronic distributor. Performance Distributors even offers a ready-to-install set of spark plug wires for this setup. By the way, the distributor housing also provides a mounting location for a mechanical fuel pump, to the engine-right of the distributor.





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1) If you're using coilpacks, grab a set of high performance spark plug wires.

2) My coilpacks (which can be used either with an EFI or distributorless carburetor setups) are MSD #8245 coils. Eight coils are used, with one coil dedicated to each spark plug. The MSD coils deliver up to three times the spark energy of the stock coils, as well as delivering multiple sparks. Maximum voltage is 44,000 volts. Primary resistance is a mere 0.570 ohms.

3) I mounted the MSD coilpacks to a pair of Moroso aluminum valve covers using Moroso's very cool hinged (and removable) coilpack brackets.

4) MSD's 6LS timing controller #6010 provides total ignition control and is fully adjustable for timing curves and rev control.

5) The MSD timing controller can be adjusted in mere seconds by plugging-in any of the six supplied timing curve modules. Or if you prefer, you can cable-connect the controller to a PC computer and (using the supplied software CD), create your own custom ignition curves. The supplied timing curve modules simply plug into the side of the controller and can be changed at will.

6) Fuel Reg The Edelbrock Super Victor Jr. intake manifold is a single plane high-rise unit that accepts a square-bore 4-barrel carb, with an operating range up to 8,000 rpm. ulator, Plumbing & Controller

7) The Edelbrock Super Victor intake ports nicely match the OE-style cathedral port shape.

8) It's always difficult to capture an exact moment on a monitor with a digital camera. While I didn't manage to capture our peak 625.4 HP moment, here's a shot on the way up, at 589.3 HP (hey, if you don't believe me, you can call Scott and verify the 625.4 HP run).

9) While the MSD timing control module provides plug-in program chips, it's surprisingly easy to create a custom timing curve by connecting a USB cable from the MSD box to a laptop computer. MSD's software walks you through the procedure. Here Scott Gressman of Gressman Powersports (Fremont, OH), adjusts our MSD's rev limiter.

10) The carb I used for my LS2 build is Edelbrock's Performer, featuring a healthy 800 cfm. Edelbrock recommends this for an LS that features more than 6.0L if displacement.

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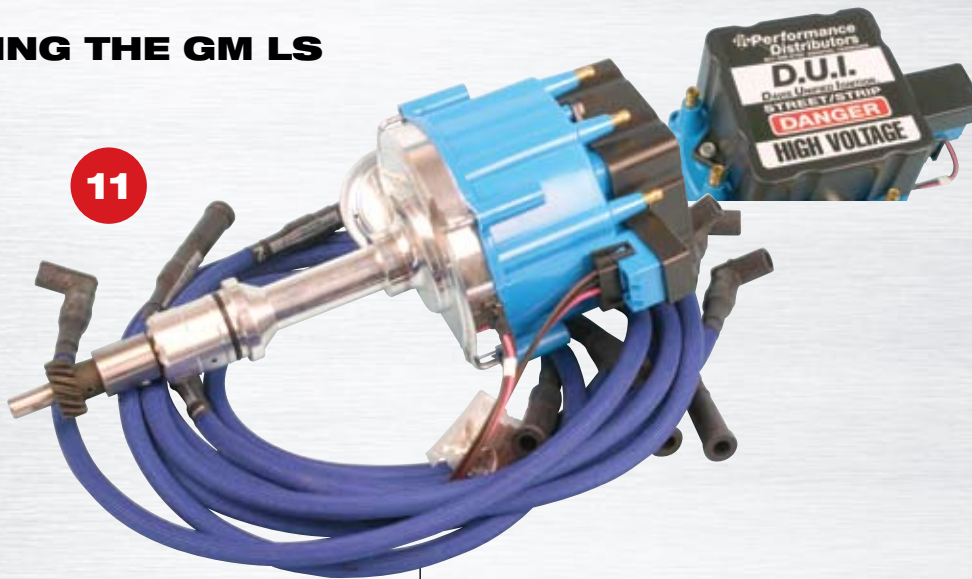
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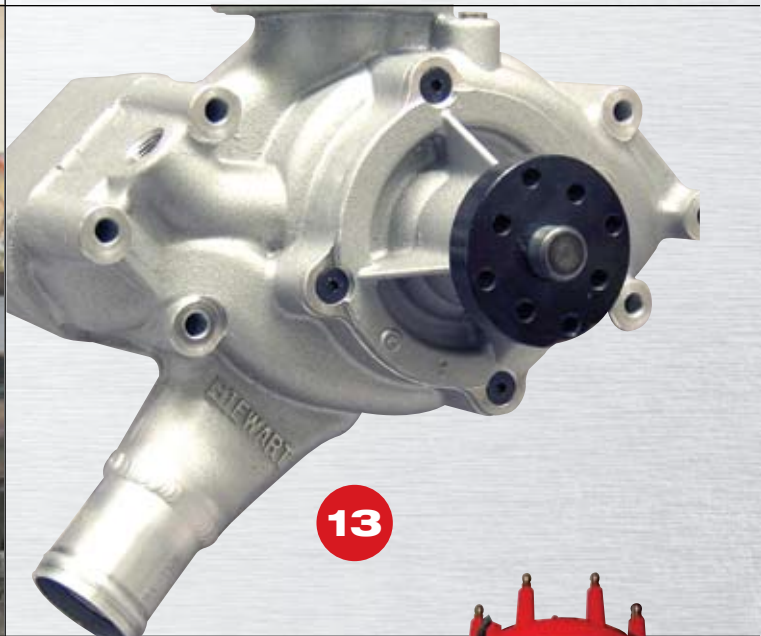
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11) If you do opt to run a distributor, Performance Distributors (DUI) offers a very cool Ford smallblock unit that features a handy HEI coil, eliminating the need for a remote-mounted coil.

12) When we ran my carbureted LS2 on the dyno, we pulled 625.4 HP in a heartbeat.

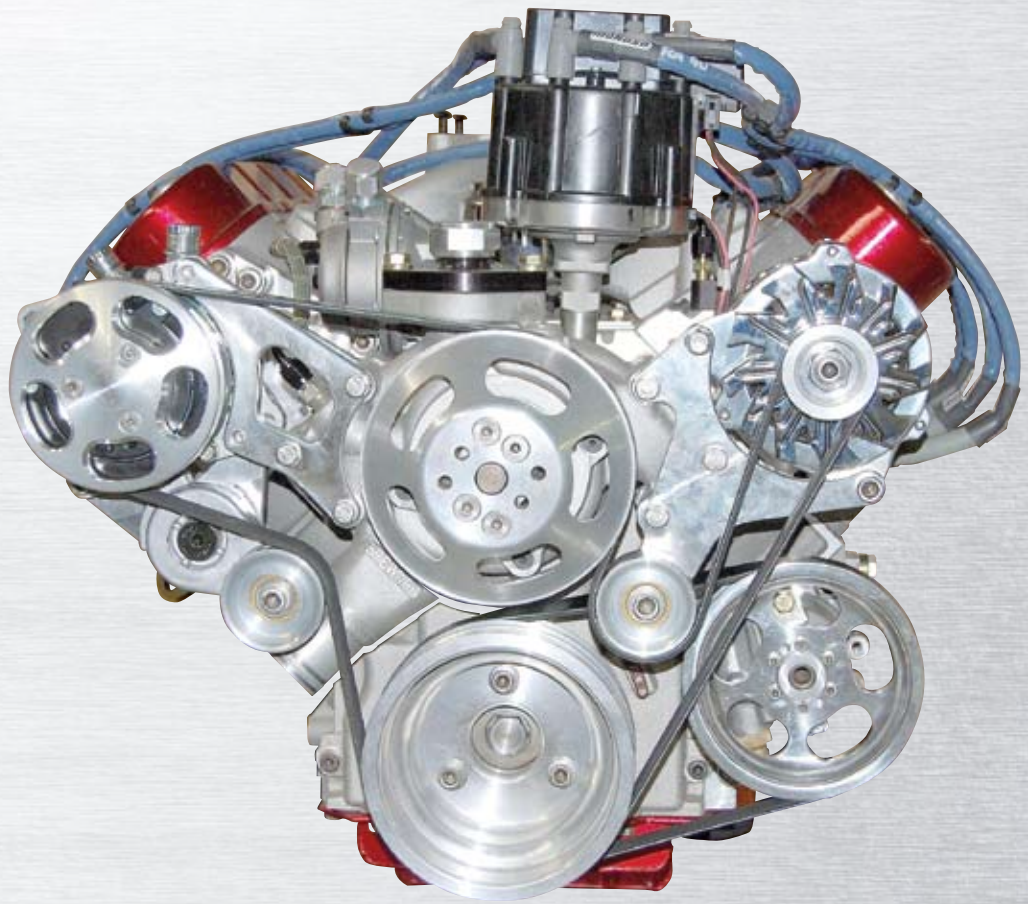
13) Stewart makes the special Stewart/Wegner water pump needed for the distributor setup. Since the OE water pump will not clear the distributor adapter housing, this special pump is a requirement for an LS with a distributor.

14) If you decide to run a carb and a distributor, you'll need GM's front-mount distributor adapter kit, which includes the distributor mount casting and a camshaft nose extension — this provides a gear connection to the distributor.

(Photo courtesy of Wegner Motorsports)



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Here's a finished LS engine with a carb and distributor setup. Going this route gets to be very expensive, due to the distributor adapter, the big bucks water pump and the special pulley system.

(Photo courtesy of Wegner Motorsports)

Now for the downside of a carb-with-distributor setup...going this route gets expensive. Since the distributor housing is, well, large, it's obvious that the OE design water pump won't fit anymore. Wegner Motorsports, in cooperation with Stewart, makes a unique LS water pump that is designed to work with this setup. The GM distributor housing kit runs approximately \$350 to \$400+, and the special water pump will run around \$400 or so. In outward appearance, in essence, it kinda resembles an OE style pump with longer legs to clear the distributor housing. In addition, because the water pump pulley now sticks out further from the block, you'll also need a special pulley system (also available from Wegner...call 920-394-3557).

I had originally intended to try out both systems.....a carb with the MSD coilpacks and controller, and a carb with a distributor. The only problem I encountered was actually obtaining one of the GM front distributor drive cover kits. I ordered one, and about three months later, still nothing. I ordered it through SDPC, but it's not their fault. Apparently, GM doesn't stock many of these on the shelf, so (at least going by my experience) if you order one through GM, be prepared to wait. It's unfortunate, since I had planned to dyno

the engine equipped with this carb and distributor combination as well. But as we all know, sometimes things just don't go as planned. The GM adapter kit is listed on page 275 in the 2008 GM Performance Parts catalog.

By the way, I later learned that the distributor adapter kit is actually made by Wegner for GM, so apparently you can buy one direct from Wegner. Had I only known. Because of the added cost in executing a carb/distributor conversion, you've really gotta want this setup to justify the expense.

A SAMPLE BUILD: AN LS ENGINE WITH CARB AND COILPACKS

I recently built an LS2 with a carburetor setup. My build featured a new LS2 (6.0L) aluminum block, purchased from Scoggin Dickey (a well known GM performance parts stocking dealer). The block was then overbored by a mere 0.005" (to 4.005"), and a Lunati 4.000" stroker crank and Lunati 6.125" H-beam connecting rods were employed to achieve a final displacement of 403.13 CID.

The remainder of the build involved a pair of Trick Flow aluminum heads, a custom-grind roller cam from Crane (0.624" valve lift & 256/264 deg. duration @0.050"), off-the-shelf JE

pistons (our compression ratio was 10.6:1), Harland Sharp aluminum roller rockers, and the Edelbrock Super Victor intake manifold and Edelbrock 800 cfm carb. The ignition consisted of MSD coil packs, and MSD timing control module. On the engine dyno, the motor easily pulled a documented 625.4 HP and 534 ft-lbs of torque without breaking a sweat. Throttle response was incredibly quick. The result: a non-computer-controlled lightweight V8 that can shatter glass from downtown high-rise office buildings, and can snap your neck under wide open throttle. Not bad for "old school." ■



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