



GM LS Engine Gauges Installation Guide

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This Guide will cover all of the current GM LS “style” engines, including but not limited to: 4.8L, 5.3L, 5.7L (LS-1 Version only), 6.0L, LS1, LS2, LS3, LS4, LS7, & LS9 engines.

LS history:

The LS engines were introduced in the '97 Corvette, and followed in the '98 model F-body (Camaro & Firebird) as the standard V8 options. The Pontiac GTO, Pontiac G8, and 05 and later Grand Prix (w/ V8 option) used this type power plant as well. GM trucks started using this type of engine in '99 with the 4.8L and the 5.3L. Be careful, since in '99 the Chevy truck also used the 4.3, 5.0, and 5.7, all of which are non-LS engines, and for the most part will not pertain to the information below.

By 2001 all GM Trucks with a gasoline V8 (other than the 8.1L) could be considered an LS engine. Express Vans were still using the earlier, non-LS engines and did not start to use the LS platform engine until 2003. The Truck and Van market can be a bit confusing, but remember there is one way to know which you have, if you are in doubt:

- All LS engines have coil-per-cylinder (DIS) ignition, while preceding engines used a distributor at the rear of the engine to supply spark.

There are also many “crate” engines which are new engines bought from a company to put into an after market application. Typically, you will find these to be 5.7L and larger, although there are a few 5.3Ls out there offered. Crate engines can be purchased as a complete, ready to drop in and turn key system, or can also be purchased bare, with no engine management system, no intake, no exhaust, no wiring, etc. When someone uses the word “crate” it simply means that it was purchased new, and is not a donor from a wrecked vehicle. Later, throughout this guide, we will visit and address some of the issues with crate engines, and the ever-so-popular task of transplanting an engine from what it originally came in, into a custom vehicle.

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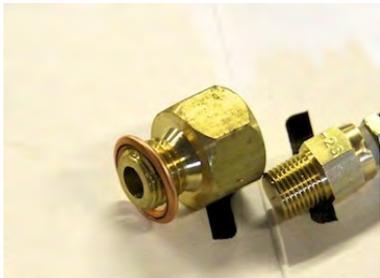
Water Temperature

NOTES:

For water temperature, there is a port located on the right side (passenger side) of the engine, in the cylinder head, past the last exhaust port (closest to the firewall / flywheel). There is a plug threaded in this location, that can be removed. This threaded in plug will either require an 8mm Allen Wrench, or a T52 Torx bit. There will be no noticeable difference in temperature reading when using the shorter sender. The 2277 adapter requires a $\frac{3}{4}$ " wrench, and the 2259 sender requires a 12mm wrench. Be careful to only tighten the adapter into the head until the crush washer is flattened. Do not over tighten.



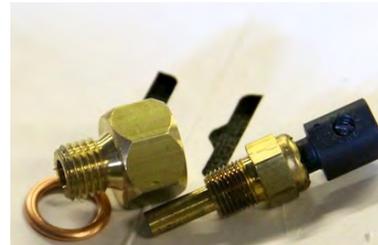
To install a short sweep electric gauge sender: You will need a model number #2277 adapter, and a #2259 sender (both included in the LS Installation kit). The #2259 sender is necessary since the probe of the #2258 (normally included sender with your gauge kit) will NOT go through the adapter. The #2259 is a probe-less sender, using the same resistance range as the #2258. Do not attempt to drill out the 2277 to accept the standard 2258 sender as there is not enough adapter material to maintain the proper thickness and strength.



NOTES:



- To install a full sweep electric gauge sender: (i.e. #2252 which uses a 2-wire plug in connector), you will use the #2277 adapter, but due to the smaller probe diameter of the full sweep sender, you may use the included sender that normally comes with the full sweep gauge. The 2277 adapter requires a $\frac{3}{4}$ " wrench, and the 2252 sender requires a 13mm wrench. Be careful to only tighten the adapter into the head until the crush washer is flattened. Do not over tighten.



To install a mechanical gauge: (which uses a permanent capillary tube). You will only be able to use that same port if you are willing to re-drill and tap your cylinder head to accommodate a $\frac{3}{8}$ " npt fitting. Then use model #2263 adapter. This practice is more involved and recommended for experienced mechanics. An alternative option would be to use a radiator hose adapter, available under model #2282 & #2283. When using a radiator hose adapter you will need to verify that you have enough length of capillary tube to reach from the desired gauge mounting location to the radiator hose adapter installation point. Radiator hose adapters also come with the $\frac{3}{8}$ " npt adapter, so an additional #2263 is not necessary for this installation type.

Oil Pressure: Located just above the oil filter there is a cast aluminum “cavity”, “plate”, or “cover” that is held on with two small headed bolts. Some have a spout pointing upward about an inch or so. Some of these engines (most commonly in trucks) have an engine oil cooler, which may use a steel block with a pair of oil cooler hoses going to it, in this same location, rather than the cast aluminum piece. You will have to remove this component, but save the gasket for when it is time to re-assemble.



- Before removal, observe, or mark on this part, where you have ample clearance for the sender or pressure line. If there is no room for a sender due to aftermarket headers, you may then use a stainless steel line kit, such as an Auto Meter 3227 to remotely mount the sender.

Remove the cover plate. To do this you will remove the two bolts, using a 10mm wrench or socket & ratchet. Save the bolts and gasket from this cover plate. You will get a temporary trickle of oil when this is removed.

- Remove the cover plate.
If your cover had the spout, you may use the spout as your pressure port. Cut 1/4" to 3/8" of length of the spout off. This is necessary, since the existing hole in the spout is slightly too large to properly tap with the 1/8" npt pipe tap.



Fuel Pressure

Fuel Pressure: The fuel pressure test port will be found on the driver's side (left side referenced when sitting in the vehicle) fuel injector rail. In any of the below instances, you will have to de-core the fuel pressure test port. A common tire valve stem core removal tool will work well for doing this. There are 3 ways to obtain pressure from this port.

- First option is to use an Auto Meter stainless braided line kit # 3227. You will thread one end of the line onto the pressure port. Then install one of the included fitting that comes in the line kit into the opposite end of the line, allowing you to thread the sender into the end of the line. You would then remote mount the sender on the fenderwell or firewall
- Second option is to contact Metco Motorsports. They offer a 1 piece adapter to allow you to thread the sender onto the pressure port. Their number is :(864) 332-5929.
- Third option is use a pair of Earls fitting to adapt to the pressure port. #923104 & #991001. This will adapt and lay the sender on its side.



- After cutting a section of the spout off, finish-drill the inner portion of the spout with your 5/16" drill bit and follow through the 1/8"npt tap. When the sender is installed, it will be standing up on end.



- If cover does not have a spout, then simply observe where you want your port to be on this plate, and mark the location.
- Use a center punch to mark your location for drilling. You may drill on the rounded portion of this plate, and using a center punch will help to get the drill bit started where you want it.
- Drill straight through the component with a 5/16" drill bit.
- Use a 1/8"NPT pipe tap through the newly drilled hole.
- Blow out your shavings, then thread the sender, or line fitting in.
- Re-install using the same gasket.

Alternatively, you may use a metric fitting where the original factory oil sender was, behind the intake. These are most commonly 16mm x 1.5. We offer a 16mm x 1.5 metric adapter under model #2268 (included in the LS installation kit). On some factory applications, the area on the rear of the engine is very difficult to reach, while on many truck and after market engine swaps, this area can be easily accessible. If removing the factory sender will cause problems, or if this area behind the intake is too difficult to reach, then resort to the previous modification of the cover plate above the oil filter.



Oil Temperature, Voltmeter, Fuel Level



Oil Temperature: All of the previous with oil pressure applies as long as you use an electric gauge. There is room (especially if you plan ahead) to install an oil pressure, and 1/8"npt oil temperature port on the same cover plate. Using a mechanical oil temperature in this location is not recommended due to the size of the probe requiring a minimum 3/8"npt (with a 2263 adapter), which measures nearly 5/8" in diameter.

Volt Meter: No special LS requirements. Simply key on power to the "I" terminal, and chassis ground to the "GND" terminal. Do not use the "S" terminal.

Fuel Level:

If the LS motor is still in its original application or the original fuel tank stayed with the engine during the transplant, then use the fuel level gauge that matches the original application. Example: if it is from a 2001 Camaro, you would need a gauge that worked with 40-250 ohms (aka Full Sweep Electric Programmable). If it is in an application where the fuel tank matches the vehicle, but not the engine, then use what matches the vehicle. Example: if this was put into a '69 Camaro, with an original tank and sender, you would then use a 0-90 ohm gauge. Either use an ohm meter to measure the resistance through your sender, or contact us for assistance to help determine what sender you have. If it is in an application where a completely aftermarket sender, or fuel cell is used, you will then need to use a fuel level gauge that matches whichever sender you purchased.

Speedometer

If the transmission (automatic) does not shift properly when the speedometer is connected, but then resorts back to shifting properly when the speedometer is disconnected, the first test will involve measuring the resistance through the speedometer. This generally happens only when using the VSS HI. You may try to use the Speedometer output wire from the computer instead, however if that circuit does not function, then continue reading below:

Sometimes adding the speedometer to the VSS circuit can impose a load onto that circuit that the circuit simply can not handle. Use your volt/ohm meter and with the speedometer completely disconnected, connect the positive of your ohm meter to the SIG terminal of the speedometer, and negative of your ohm meter to the GND terminal of the speedometer



If you get a measurement of 2.9K, you may then send the speedometer into us for service to have an internal circuit modification performed. This modification in most cases will remedy the problem. If you get a measurement of 4.6K or higher, then no modification is needed.

If you have further questions, or need assistance with trouble shooting, please call our tech support at 866-248-6357.

Speedometer

Speedometer Troubleshooting:

If the speedometer simply does not function with it connected one way (such as to the speedometer output wire from the computer), then connect the speedometer to the VSS HI instead. If you are already connected to the VSS, then connect to the "other" VSS wire. Sometimes the wire colors can vary from application to application, and sometimes terminal "B" of the VSS is NOT VSS HI, as mentioned previous (although most times it is). If you connect to the incorrect VSS wire, you are not going to risk any damage to the VSS, the computer, or the speedometer.

If the speedometer still does not function, and there are no other symptoms (such as no automatic transmission shifting problems), you may use a digital volt meter to measure the signal to the speedometer.

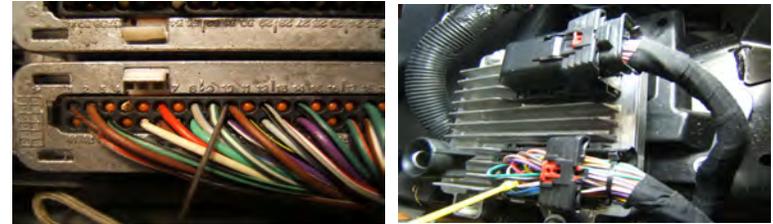
Set your meter to AC Volts. Connect the positive lead of your volt meter to the signal wire you are using for the speedometer. Connect the negative lead of the volt meter to chassis ground.

With the signal wire disconnected from the speedometer (but still connected to the speed sensor) you should see zero volts. When you start rolling the vehicle (or at least running the drive-train on a lift, or dyno), you should see AC voltage climbing with speed. Generally you need to see a minimum of 1.8VAC for the speedometer to respond. If you do not see this then you may be dealing with an open circuit between the speedometer and speed sensor, or a faulty speed sensor, or a non-grounded speed sensor. The 2nd wire of the speed sensor is generally grounded by the computer or trans controller.

Tachometer

Listed are the most common ways to hook up a tachometer signal wire to the most popular applications that tend to have an existing tachometer signal:

- 98 F Body: Pin #35 of the blue PCM connector.
- 99-02 F Body: Pin #10 of the red PCM connector.
- LS equipped truck applications: Pin #10 of the red or green PCM connector (it will be either red or green, it will not have both). Not all trucks will have a tach signal wire.
- 97-98 Corvette: Pin #35 of the blue PCM connector, white wire.
- 99-04 Corvette: Pin #10 of the red PCM connector, white wire.
- 05-06 Corvette: Pin #48 of the blue PCM connector, white wire.
- 07-09 Corvette: Pin #48 of the black PCM connector, white wire.
- 04 GTO: Pin #10 of the green PCM connector, brown wire.
- 05-06 GTO: Pin #48 of the blue PCM connector, brown wire.
- 05 Cadillac CTS 5.7L: Pin #10 of the green PCM connector, white wire.
- 06-07 Cadillac CTS 6.0L: Pin #25 of the blue PCM connector, white wire.



All of the above will require the tachometer to be set for 4 cylinder, 2 pulse signal. If the tachometer fails to operate, there are several ways to handle this. Each case may be a little different.

If the tachometer does not function:

You may check the original tachometer circuit. You can do this with a digital voltmeter.

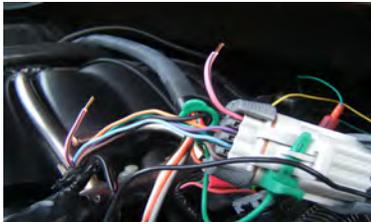
- Connect the positive lead of the voltmeter to the tachometer signal from the PCM.
- Connect the negative lead of the voltmeter to a good chassis ground.
- With your meter set on DC volts, start the engine.
- Monitor what you have at idle. You should have a low figure that ranges anywhere from 0.5 to 3.0 volts (and remains rather steady).
- At a high-raised idle, it should be significantly more. As an example, if you measured 1.0v at idle then at a raised engine speed you may see 3v, or more.
- There is no "spec" for the amount of volts you will see. What you are looking for is an increase. For example: If you saw 1.0v and idle, then measured 1.1v with raised engine speed, then that signal is not changing, or operating normally.
- If there is little to no activity, you may use a resistor to try and restore the weak signal. Installing the resistor: Use a 10K, 1/2 watt resistor (supplied in the LS Installation Kit). Solder one leg of the resistor to the tachometer signal circuit. Solder the other leg of the resistor to a 5v reference circuit. You may use a wiring diagram that pertains to your engine computer to determine what pin #, and wire color will be a 5v reference. *Hint: GM most commonly tends to use a solid gray wire for 5v reference, however you will still want to verify this with your wiring diagram, and a voltmeter set to DC volts. Do NOT use a 12 volt power supply or source for this. This may cause damage to the PCM.

Tachometer

If the PCM supplied tachometer circuit functions, but the tachometer does not: Take normal steps in diagnosing the tachometer. You may also try the tachometer on another vehicle. If it works on another vehicle, but not on your LS engine, then check the date code of the tachometer. Some older units (manufactured prior to 2007) may require a 5v calibration. All newer Auto Meter tachometers should not require this modification. Autogage tachometers may or may not function and CAN NOT be modified for 5v calibration.

If the PCM supplied tachometer circuit does not function, and you have already tried the pull-up resistor: This will then require using a tachometer adapter. This is not uncommon when the computer (PCM/ECM) has been re-programmed or flashed. Some LS applications may have no wire for tachometer signal, or the computer may simply produce no tachometer signal. In this case a 9117 tach adapter will be required. The following details the steps required to install the 9117 on an LS engine.

Most commonly with original, and aftermarket engine wiring harnesses, the ignition coil power supply wire color is pink. Any applications using the adapter will be calibrated to 8 cylinder, 4 pulse. Cut the pink power supply wire at each bank, prior to the coils splitting. This pink wire can be cut just prior to the wiring connector at the center of each valve cover.



- The cut halves coming from the harness (not the halves going to the coils) will still have power when the key is on. Join the left and right bank power halves together. Splice these two power halves (now together) to the solid red of the 9117 adapter.



- Now, join the coil-side cut halves together (left and right bank).
- Splice these two coil halves (now together) to the red wire with a green stripe of the 9117 adapter.



- Ground the black wire of the adapter to an engine ground.
- The gray wire of the adapter will be your new tachometer signal. You do not want to try to “cheat” and use just one bank of coils, as the signal will appear very erratic.

If the tachometer now functions well, but quits when above “x”-amount of RPM such as 4,000, then a shunt resistor will be needed. This is a 0.1 ohm, 3 watt resistor. Connect one leg of the resistor to the red adapter wire, and the second leg of the resistor to the red/grn adapter wire. This will allow some of the current to bypass the adapter, and still allow the tachometer adapter to function.



- Speedometer:** You will want to use an electric, programmable speedometer. You will run a new wire from your speedometer “SIG” terminal on the rear of the speedometer, and connect the other end of this wire to the VSS HI wire. If you are unsure of what wire on your vehicle is considered VSS HI (or sometimes referred to as VSS +), you may consult the appropriate diagram for your computer (or transmission controller), or simply call our Tech Support at 866-248-6357.
- You may tap/splice onto this wire anywhere between the computer and the vehicle speed sensor.
 - If connecting at the speed sensor, and you are unsure of which wire is which, you may closely inspect the connector and try connecting to terminal “B” of the VSS.

Another option for getting your signal is to use the existing speedometer output wire from the computer or transmission controller. Much like the tachometer wire, sometimes this simply does not function, even when there is a wire there.

Whichever way you choose to connect the speedometer above (the VSS, or the speedometer output wire), as long as the speedometer functions, the last step will be to calibrate your speedometer (per the instructions that come with the speedometer).