



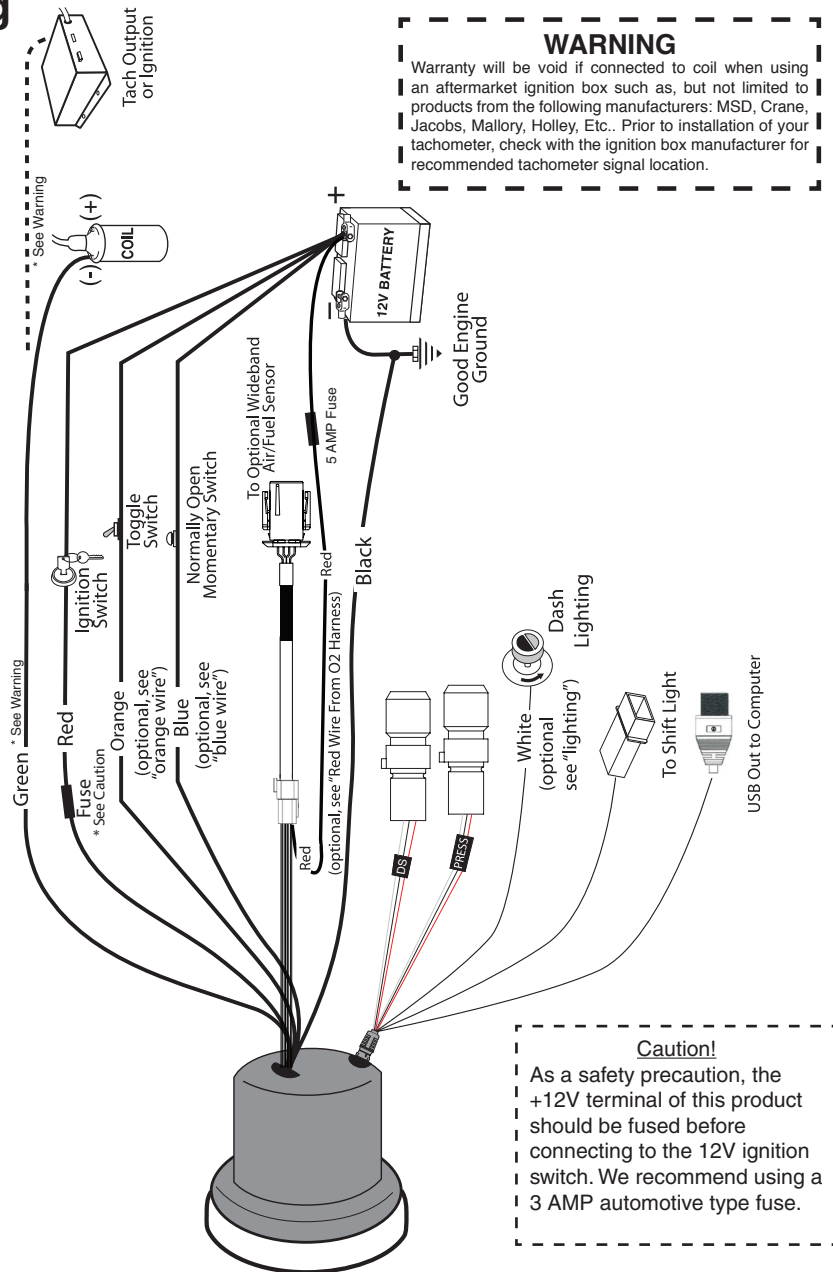
INSTALLATION INSTRUCTIONS ULTIMATE DL PLAYBACK TACHOMETER

2650-1690-00 Rev. D



Thank you for purchasing the Auto Meter Ultimate DL Tachometer. This is the most advanced tach we've made in over 50 years of building the world's finest performance instruments. The Ultimate DL not only records engine RPM, but also driveshaft RPM, wideband air/fuel ratio, a user definable pressure channel and three G meters to show exactly how the vehicle is moving down the track. This guide will walk you through installation and familiarize you with its functions and operation.

Wiring



Blue Wire

In some cases, the driver will not be able to reach the tach buttons once they're strapped in the vehicle. In these instances, a normally open, momentary switch can be installed between the blue wire and the 12V power source. This will allow the driver to remotely arm the tach to record. The process of "arming" the tach is explained in the RECORD section of the instructions. Additionally, this button can be used to change the channel on the display, when in normal tach mode. Per NHRA rules, the blue wire cannot be connected to the transbrake. The tach will not function if this is done.

To record a run using the blue remote trigger wire.

Just like when using the buttons on the tach, press Enter (■) on the Record mode and the tach will display "Ready". This can be done at any time prior to your run. Instead of Pressing Enter (■) to "arm" the tach, you can use a normally open momentary push button on the blue wire to apply 12V. Hold the button for at least one second and release it. Once that 12V is taken away, the tach will move to "Armed". Your recording will automatically begin when engine RPM reaches the threshold you set earlier (See RPMThres). The recording will then run for 60 seconds. You don't need to press anything to stop it and the run will automatically be saved, even if you shut down the vehicle.

Playback

Pressing Enter (■) under the Playback menu will allow you to play back your run on the tach itself. You can have up to 4 different runs stored on the tach at one point in time. You can move between them using the Set Run menu item. You can switch between sensors on the display using the PB Chan menu item. The pointer can either display Engine or Driveshaft RPM by using the PB PTR menu option.

PB Speed (Playback Speed)

When playing back a run, you can play it at full speed (real time), 1/2 speed or 1/3 speed. Simply use the Up (▲) and Down (▼) Arrows to select the speed you want and press Enter (■) to save. You can also press Cancel (X) to back out without making a change.

Download

Connect the USB cable (not included) between the tach and the PC. Using the Up (▲) and Down (▼) Arrow to select Download and then press Enter (■). Start the DataPro Software included with the Tach. Click on the Recorder Menu and select Playback Tach Download or press F9. Click on the Download button. The display on the Ultimate DL will show "Init DL" while data is being transferred. This should take about 5 seconds. Then the display will show "DL done" to indicate the download process is complete. Press (X) to exit the download mode.

Sensor Kits

- 9134 - 15 PSI - with 8' Cable
- 9135 - 100 PSI - with 8' Cable

NOTE: For 30, 60, 250, 500, 1600 psi sensors, or custom cable lengths please contact Auto Meter Customer Service at 866-248-6356 or sales@autometer.com.

9133 - Wideband sensor and cable kit.

9531 - Strange Ultra Case Drive Shaft Sensor

Optional Magnet Collars

- 9387 - 1.875" I.D. Four Magnet Collar
- 9388 - 2.125" I.D. Four Magnet Collar
- 9389 - 1.49" I.D. Machinable Four Magnet Collar

Operation

This is your normal operating mode. When Tach is selected, the pointer will display the current engine RPM and the shift light will always come on when the RPM reaches the first shift point (see Set SP for more information). This is the default setting for the Ultimate DL and will always come up when the unit is powered up.

PB Chan (Playback Display Channel)

This setting allows you to change which reading is shown on the tach's digital display. This holds true whether you are in normal operation, making a run or playing back a run on the tach itself. Press Enter (■) to begin. Using the Up (▲) and Down (▼) Arrows, you can select between Engine RPM, Driveshaft RPM, Pressure, Wideband Air/Fuel, Lateral, Longitudinal or Vertical G's. Please note that due to NHRA rules, Driveshaft RPM and the G Meters cannot be viewed when the tach is recording. The display will go blank during your run if one of these is selected. Driveshaft RPM will only be shown in **PLAYBACK** mode. The display will be blank in **TACH** mode.

When playing back a run on the tach dial itself, you can watch either the engine or the driveshaft speed. This option allows you to select between the two. Press Enter to start and use the Up (▲) and Down (▼) Arrows to select between the two. Press Enter (■) to save or Cancel (X) to exit without making a change.

PB PTR (Playback on Pointer)

When playing a run back on the tach itself, you can watch either the Engine or Driveshaft RPM. This option allows you to select between the two. Please note that the tach will always display Engine RPM under normal operation, regardless of your setting here. Hit Enter (■) to start and use the Up (▲) and Down (▼) arrows to select between the two. Hit Enter (■) to save or Cancel (X) to exit without making a change.

Set Run

The Ultimate DL can record 4 separate 60 second runs. Pressing Enter (■) on this setting will allow you to select different runs using the Up (▲) and Down (▼) Arrows. Once you've selected the run you want to use, press Enter (■) to save or Cancel (X) to back out without making a change. The tach will always stay on the run you currently have selected and will simply overwrite the existing run if you record and new one and there is one stored in memory. As an example, Run 4 cannot be affected if you have Run 1 selected. Making two recordings on Run 1 will automatically erase/overwrite the data from the earlier run.

Record

This is the menu you use when you are ready to record a run. There are two ways to trigger a recording, either by using the buttons or by remote triggering along the blue wire.

To record a run using the buttons on the tach:

When you are in Record mode, press the Enter (■) Key and the display will show "Ready". This can be done at any time prior to your run. Press the Enter (■) Key again, and the display will change to "Armed". Your recording will automatically begin when your engine RPM reaches the threshold you set earlier (See RPMThres). The recording will then run for 60 seconds. You don't need to press anything to stop it and the run will automatically be saved, even if you shut down the vehicle.

Orange Wire

When using the optional wideband O2 sensor, the tach needs to see 12.5V or higher to turn on the sensor. Potential sensor damage can occur if the gauge begins to heat the sensor before the engine is running due to condensation that forms on the sensor tip and in the exhaust. If your vehicle does not run an alternator or for some reason doesn't have this much voltage in the system under normal operation, the Orange wire can be used to bypass this voltage check and turn on the O2 sensor. Simply apply 12V to the orange wire and the sensor will turn on. You can wire this to a toggle switch for more control or simply to your key-on power if you want the sensor to turn on every time the vehicle is turned on.

Red Wire From O2 Sensor Harness

The O2 sensor draws a fair amount of current, much more than what the tach does. In order to protect the tach from these potentially damaging current levels, the O2 sensor gets its own power supply. As the tach has to tell the sensor when to turn on, this can be wired directly to battery power. It will not draw down your battery as it cannot be activated without a signal from the tach.

Drive Shaft Magnet Installation

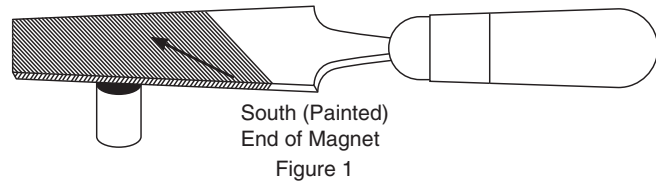
NOTE: An aluminum collar is available for most models to hold the magnets. Please call Auto Meter Products for further information.

Although it is possible to install magnets without removing the four universal joint bearing caps that are attached to the differential pinion end yoke; it is highly recommended that they be removed. This allows for a better job of cleaning surfaces, and applying the J-B Weld brand adhesive.

Caution: Use J-B Weld brand adhesive only. Many other brands were tested, and only J-B Weld withstands the centrifugal forces encountered.

1. Remove the U-bolts or straps that retain the universal joint bearing caps to the end yoke on the differential.
2. Slide the driveshaft forward into the transmission while being careful not to allow the bearing caps to fall off the universal joint.
3. Gently slide the two bearing caps that were contained by the end yoke off of the universal joint cross. Be careful not to lose any of the needle bearings.
4. Place needle bearings in a safe place until ready to reassemble.
5. Clean any surface rust (etc.) from bearing cap end with a wire brush attached to a bench grinder or drill.
6. Using the 80-grit emery paper supplied, roughen up the end of the bearing cap to improve J-B Weld adhesion.
7. Using the sharp edge of a file, scratch the yellow end of the magnets so that the end can be identified after the paint is removed during cleaning of the magnets. (See Figure 1)

NOTE: The magnet is painted yellow on one end to identify the south side. The sensor supplied will only work with the end of the magnet.

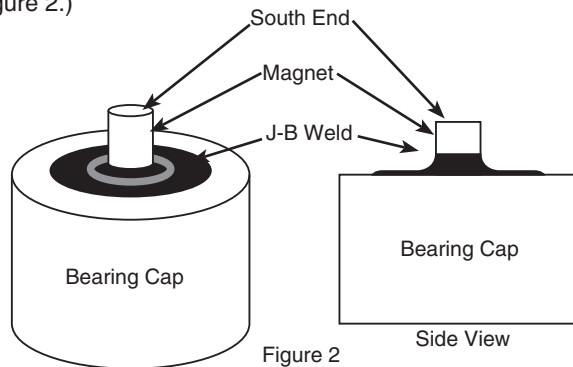


8. Using a CLEAN rag, apply acetone or lacquer thinner to the rag. Wipe the bearing cap ends and magnets clean. Allow the cleaner to evaporate.

NOTE: The surfaces must be clean, and free of all residues to provide a strong bond with the J-B Weld.

9. J-B Weld consists of two parts. Squeeze equal parts from each tube onto any clean disposable surface. Mix together thoroughly with the wooden stick provided.

10. Apply a small amount of J-B Weld onto the end of the bearing cap. With the south side of the magnet facing away from the J-B Weld and bearing cap, place the magnet in the center of the J-B Weld on the bearing cap as shown. (See Figure 2.)



11. Tear off a thin piece of paper, and place it onto the 5/8" diameter steel slug. Place the paper and slug onto the south end of the magnets as shown. (See Figure 3.)

NOTE: Since J-B Weld has steel in it, the J-B Weld will be attracted to the south end of the magnet, and will flow away from where its needed most. The steel slug placed on the south end of the magnet prevents this from happening. The paper prevents bonding of the steel slug to the magnet.

Set Pres (Set Pressure Scale)

The Ultimate DL allows you to record a pressure channel on the engine when connected to an optional pressure sender. This is most often fuel pressure, though it could also be boost pressure, oil pressure or really just about any other. Pressing Enter (■) on this setting allows you to tell the tach what type of sending unit you're using (15, 30, 60, 100, 250, 500 or 1600 psi) Press Up (▲) and Down (▼) arrows to change the settings. Press Enter (■) to save.

Filtr PSI (Filter Pressure Channel) Pressure channels can look very jumpy on playback or when graphed out. There are minor fluctuations that are always happening, even with high end electronic pumps. Because the Ultimate DL has such a high sampling rate (higher rate = more precise), you have the option of smoothing out that channel. Press Enter (■) and using the Up (▲) and Down (▼) Arrows, select whether you want to filter the channel or not. Press Enter (■) to save your setting or Cancel (X) to back out without making a change.

Set AFR (Set Wideband Air/Fuel Stoich Point)

Not all fuels are created equally. Regular pump gas will typically be stoich at 14.7 parts of air to 1 part fuel. Racing fuels, ethanol, methanol, etc typically have a much richer stoich point. Pressing Enter (■) on this setting will allow you to configure what the tach should consider as the stoich point for your engine. Use the Up (▲) and Down (▼) Arrows to change the value and press Enter (■) to save or Cancel (X) to exit without making a change. Some typical stoich points for common fuels are listed in chart to right. The minimum you can set is 6.0 and the maximum is 18.0.

The Air / Fuel Ratio Monitor can be used with the following fuels.	
Fuels	Stoichiometric Air / Fuel Ratio
Unleaded Gasoline	14.7:1
Methanol	6.4:1
Ethanol	9.0:1
LPG (Propane)	15.5:1
CNG	17.2:1
E85	9.765 (Use 9.7 or 9.8)

G Cal (G Meter Calibration)

The three G Meters in the Ultimate DL allow for incredibly precise tracking of the movement and position of the vehicle during your run. The G meters need to be calibrated so they know their exact position in space. This step only needs to be done once when the tach is installed. The only time you should need to do this step again is if the tach changes position/angle in the vehicle.

With the vehicle stationary on a flat, level surface, press Enter (■) to begin the calibration process. The display will read "Ready". Press the Enter Button again and the display will read "Hold". Keep the vehicle stopped and after the G meters take a stationary reading, the display will then say "Go". Accelerate the vehicle in a straight line. It is not required to have full launch acceleration. **NOTE:** Higher acceleration rates will result in a more accurate calibration. The tach needs to see 1.8 seconds of continuous straight line acceleration. Once it's gathered what it needs, the display will read "Wait". You can now stop the vehicle. The display will continue to read "Wait" for around 20 seconds while the unit performs some calculations. Once these are completed, the tach will automatically resume normal operation.

Setting Up Your Tach

Here we'll set up your tach. Most of these steps will only need to be done once, but can be changed at any time. Use the Up (▲) and Down Arrows (▼), scroll through the menu options and press the Enter (■) Button to enter that setting. Cancel (X) will always back up one step without saving changes.

Set PPR (Pulse Per Revolution – Engine Cylinder Calibration)

This is the menu you use to tell the tach how many ignition pulses it sees for each revolution of the crank. On most engines, this number will be ½ the number of cylinders the engine has because only half of the cylinders are fired on each revolution of the crank. For example, a typical V8 engine will be set to 4.0 PPR.

To set your PPR, go to the Set PPR mode and press Enter (■). Using the Up (▲) and Down (▼) Arrows you can adjust your PPR setting between .5 and 6 pulses per revolution. Once you've found the setting you need, press the Enter Button (■) to save that setting. You can also press Cancel (X) to back out of the menu without making a change. If the PPR settings are programmed incorrectly, the tach will still function but will display the incorrect RPM.

Lighting (Set Backlighting Mode):

Press (■) to see what the current mode is, Fixed or Variable. Selecting Variable makes the backlight intensity proportional to the voltage on the white wire. This should be connected to dash lighting. Selecting 'Fixed' sets the backlight intensity to a constant level. Press (▲) or (▼) to change the mode. Press (■) when desired mode is displayed. If 'Fixed' is selected, the display will show a backlighting level of 0-10, 0 is off, 10 is maximum brightness. Press (■) to change the fixed level. Press (■) to save the new level or press (X) to exit without changing the level.

Set SP - (Set Shift Points)

This menu will be used to configure the optional shift light on your tach. The Ultimate DL has the capability of indicating four separate shift points. During normal operation (not recording), the tach will always default to shift point 1 (SP1). Press Enter (■) to begin configuring your shift points. Select SP1, SP2, SP3 or SP4 and press Enter (■) again. Set the RPM you'd like the shift light to come on at using the Up (▲) and Down (▼) Arrows. Once you've reached the desired level, press Enter (■) to save your setting. You can also press Cancel (X) to exit without making a change. Once you've set and saved your shift points, press Cancel (X) to back out of the shift point set mode and go back to the main menus. During a run, the Ultimate DL will automatically move to the next shift point in sequence when it sees a 450 RPM drop.

RPMThres (RPM Threshold)

The Ultimate DL uses your engine RPM to know when to start recording your run. When your engine reaches a certain RPM, the tach knows you're about to launch and starts recording. The RPM Threshold setting is where you configure this. Press the Enter (■) button to display the threshold RPM. Move the RPM to the desired RPM by using the Up (▲) and Down (▼) Arrows. Once you've reached the desired RPM to start your recording, press Enter (■) to save the setting. You can also press Cancel (X) to back out without making a change. This tachometer has 60 seconds of record time per channel. This is important to know. If you reach the RPM threshold while doing your burnout before you stage, and the tachometer is in **Record** mode, the tachometer will start to record. If 60 seconds is not long enough, or you want to avoid having it trigger during the burnout, you may put the tachometer in **Record** mode after the burnout.

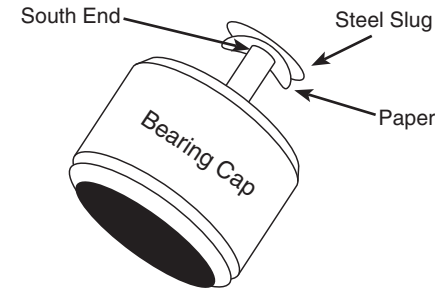


Figure 3

12. Apply a liberal amount of J-B Weld to form a cone shape as shown. (See Figure 4.)

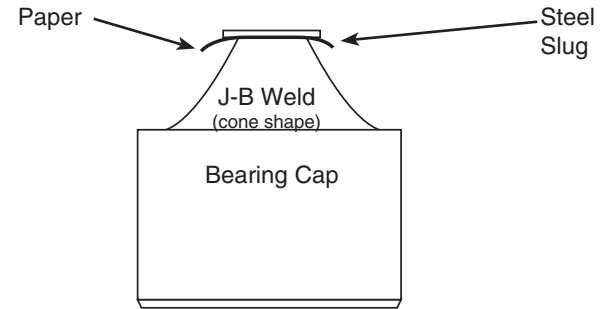


Figure 4

13. Allow the J-B Weld to cure for 24 hours before putting into use. J-B Weld cures slower if used at temperatures below 60°F. After J-B Weld has cured for 6 hours, a heat lamp or light bulb placed near the weld will speed up curing time in cooler temperatures. Do not apply heat before 6 hours of room temperature curing, as this may cause the weld to become brittle.

NOTE: In hot weather, let the J-B Weld set-up for about 15 to 20 minutes after mixing, this lets it thicken and prevents running or sagging.

14. After J-B Weld has cured, remove the steel slugs and paper. Make sure that no J-B Weld protrudes above the magnets, if so a file may be carefully used to remove the excess. Also be sure that the J-B Weld does not interfere with the bearing cap retainer tang on the end yoke.
15. Assemble the bearing caps. Use an approved grease to hold the needle bearings in the bearing caps. Make sure there are no missing needle bearings. Place the bearing caps onto universal joint cross.
16. Reassemble the driveshaft and universal joint to the end yoke. Replace the U-bolts or straps, and torque to the manufacture specifications. When magnets are mounted according to these instructions, the magnets will withstand at least 10,000 RPM. A collar is recommended for cars 10 seconds and faster.

Sensor Mounting for Driveshaft RPM Pickup

A bracket must be fabricated to hold the sensor near the magnets that were installed on the universal joint bearing caps. The bracket must be very rigid, as not to allow the sensor to come in contact with the magnets under extreme vibration. If the sensor touches the magnets they will break off, and also possibly damage the sensor. We recommend using rigid channel steel for the bracket. The bracket should be bolted directly to the differential case. This insures a constant sensor to magnet clearance with any suspension travel. Mount the sensor through a 7/16" diameter hole in the bracket. Adjust the sensor to magnet clearance to .200" +/- .030", and lock down the jam nuts supplied on the sensor. Verify the clearance is correct for all magnets. (See Figure 5.)

Optional: Driveshaft collars are available direct from Auto Meter for many performance applications. (See page 11 for details)

Rotate the driveshaft by hand to make sure there is adequate clearance between the bracket and sensor assembly and the differential pinion end yoke. (See Figure 6.) Tie the wires away from any moving objects and hot exhaust pipes.

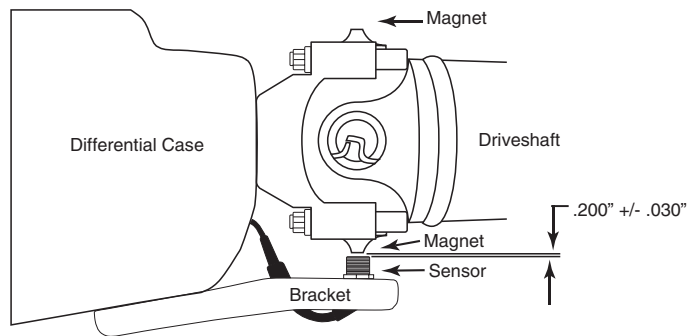


Figure 5

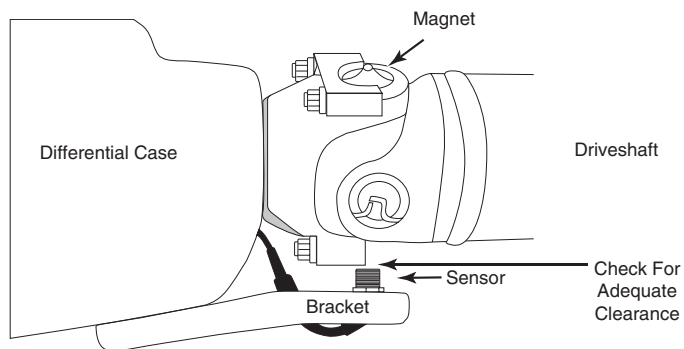


Figure 6

Installing The Driveshaft Speed Sensor

Verify that the sensor mounting bracket is mechanically very rigid, so fabrication of a sensor bracket may be required, as bracket is not included. Install so that the sensor does not come in contact with the magnets under extreme vibration. If the sensor touches the magnets they will break off, and also possibly damage the sensor. We recommend using rigid channel steel for the bracket. The bracket should be bolted directly to the differential case. This insures a constant sensor to magnet clearance with any suspension travel. Adjust the sensor to magnet clearance to .200" +/- .030", and lock down the jam nuts supplied on the sensor. Verify the clearance is correct for all four magnets.

Mounting O2 Sensor (Optional)

The heated oxygen sensor comes with a stainless steel weld-in bung, plug, and wiring harness. The oxygen sensor should be installed as close to the cylinder head as is reasonably possible so that the sensor reaches operating temperature quickly. If long tube headers are used, the oxygen sensor should be installed in the collector. If cast iron manifold(s) or shorty headers are used, install the sensor in the pipe just below the manifold. In multi-bank applications mounting in the left or right side is acceptable. Turbocharged applications should have sensor installed 4-5" after turbo on the down pipe.

Auto Meter recommends welding supplied stainless steel bung with a TIG welder.

1. The exhaust pipe in front of the sensor should not contain any pockets, projections, protrusions, edges, flex-tubes etc. to avoid accumulation of condensation. A downwards slope of the pipe is recommended. If the exhaust pipe is parallel to the ground, the sensor must be installed in the top half of the pipe to avoid damage due to condensation
2. Tightening torque: 30-44 ft lbs.
3. Avoid excessive heating of the sensor cable. Route sensor cable away from exhaust pipe.
4. The maximum temperature of the sensor on the outside of the exhaust fitting should not exceed 900° F.

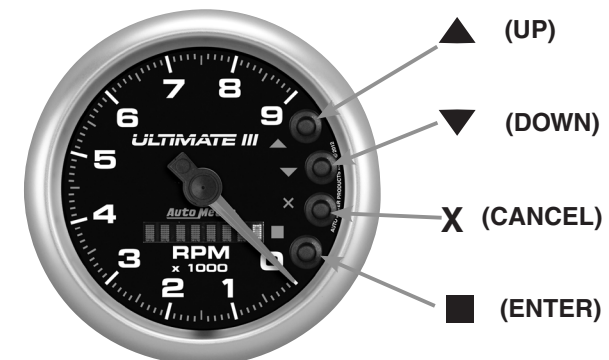
The Air / Fuel Ratio Monitor is intended for use with unleaded gasoline.

NOTE: Stoichiometric Air / Fuel Ratio is the chemically correct ratio where theoretically all of the oxygen and all of the fuel are consumed. The mixture is neither rich or lean.

NOTE: OK for use with Nitrous Oxide.

Moving Through The Menu

The Ultimate DL's functions are broken up in a series of menus. Navigating these menus is accomplished using the four push buttons on the right side of the tach. The buttons functions are:



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