



UTCIS™
Engine Management System
Application guide

UnwiredTools, LLC
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UTCIS™

*Replacement Warm-up Regulator and
Engine Management System
Application and Tuning Guide*

*This product adds tuning for performance and economy
with diagnostics for **Bosch CIS fuel injection***

*Bosch CIS fuel injection was fitted to most luxury and
performance cars built in Europe from the mid 70's to the
mid 80's*



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Mercedes models with CIS fuel injection:



280/450 SE/SEL



280/380/450/500 SL/SLC



380SE/SEL



500SEC



280E



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Porsche models with CIS fuel injection:



911/S/T/SC



924/924 Turbo



930/964



928



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Other models with CIS fuel injection:



VW 1st Series Rabbit/GTI/Jetta/Scirocco



Volvo 240/Turbo/Wagon



BMW Early 320i/530i



Ferrari 308GTSi / 512BBi



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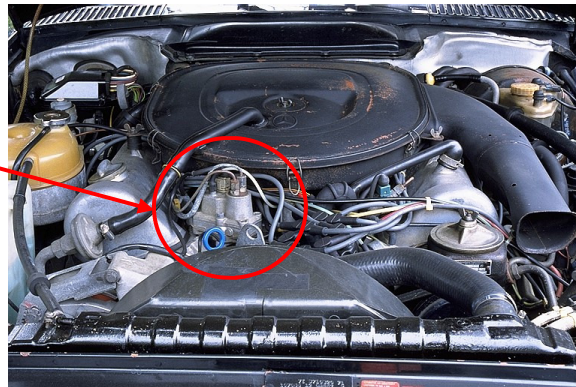
Mercedes Identification:

Mercedes 116 and 107 chassis models were built with *both* Bosch D-Jetronic and CIS K-Jetronic fuel injection systems during their production life. 123 Chassis models with gasoline engines were built with CIS fuel injection only. **The UTCIS can only be used to upgrade CIS K-Jetronic systems.**

Identification of the fuel injection system in your vehicle cannot always be accomplished using the VIN number or model year. The engine ID contains this identification but the engine ID is not always visible. Fortunately the injection system is very easy to identify visually.

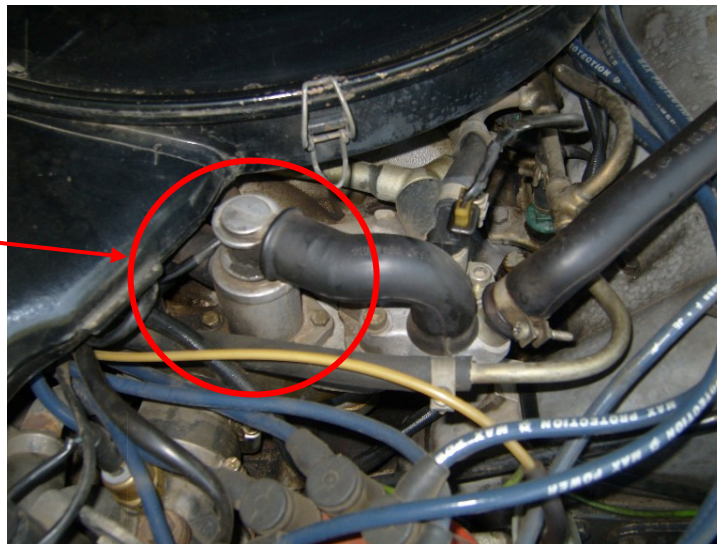
The following photo shows a 450SL engine with CIS K-Jetronic fuel injection. This system can be easily identified by the Warm-up Regulator:

Warm-up
Regulator,
this is CIS
injection



The following photo shows a 450SL engine with D-Jetronic fuel injection. This system can be easily identified by the Air Slide Valve which is not present on K-jet. Also, the D-Jet system does not have a Warm-up regulator:

Air Slide
Valve, This
is NOT CIS
injection





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Tuning Procedure: The versatility of the UTCIS-V product allows you to tune your car for max power, max fuel economy or anywhere in between. This procedure explains how to get the results you want using the UTCIS-V product. *Note: the tuning procedures for the UTCIS-PT are similar.*

Setting up for the tuning procedure:

1. Using a “narrow band” oxygen sensor

On cars built in 1980 and later in the USA there is already an oxygen sensor installed from the factory. In this case you only need to tap into or disconnect the signal wire coming out the oxygen sensor and then run a wire into your interior. Some sensors have an additional two wires for a heater. Those wires should be left alone. Check your manual to find out which wire carries the voltage output from the sensor.

NOTE: Oxygen sensors wear out and need to be replaced. We recommend you replace this sensor before performing this procedure if the sensor has been in service for more than 25000 miles.

On most pre 1980 USA models you will need to have an oxygen sensor fitting installed in your exhaust system. Most muffler shops can install this fitting in a few minutes at low cost. This sensor should be as close to the cylinder head as possible while easily accessible. The sensor should be mounted not less than 10 degrees above horizontal to prevent water condensation from entering the sensor.



Bosch 13913 sensor installed in bung welded to header

We recommend the BOSCH 13913 sensor available from most local auto parts stores. It has three wires, two white (heater) and one black (voltage signal). One white wire should be powered by a fused KEY ON 12 volt source. The other white wire goes to a good chassis ground. The polarity of the white wires do not matter. The black wire should connect to a longer wire that routes in to the interior of the car.

NOTE: A wide band oxygen sensor will also work if you have the equipment or a compatible gauge already installed to read a wide band sensor. A digital volt meter by itself will not work with a wide band sensor.

2. Connecting a Digital Volt Meter

1. You will need a decent digital volt meter capable of reading accurately between 0 and 1 volt. The volt meter should be located somewhere inside the car so you can read it and still safely watch the road or have a partner check the meter while you drive. The black lead from the volt meter should be connected to a good chassis ground. The red lead should be connected to the black wire coming from the oxygen sensor.



Volt meter reading oxygen sensor in volts



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3. Adjusting the CO screw

The CO adjustment screw is an important feature of the air metering plate which controls the start and end of fuel delivery. There are two types of air metering plates, one where the air travels up and the other where the intake air moves down.

UP-draft metering plates: (VW and most Porsche)

Between the air metering boot and the fuel distributor is a small hole which is normally plugged. If the plug has not been removed you will need to remove it. To remove the plug drill a 0.086 in hole about 1/8 inch down into the plug. Do not drill all the way through the plug. If you drill all the way through you will need clean out the shavings that fall down into the metering assembly. Next tap the hole with a 4-40 tap. Use a 4-40 screw to pull the plug out.

DOWN-draft metering plates: (Mercedes)

On down-draft metering plates remove the access screw to get to the CO adjustment screw. After adjustment the access screw must be replaced before taking any readings in order to prevent un-metered air from entering.

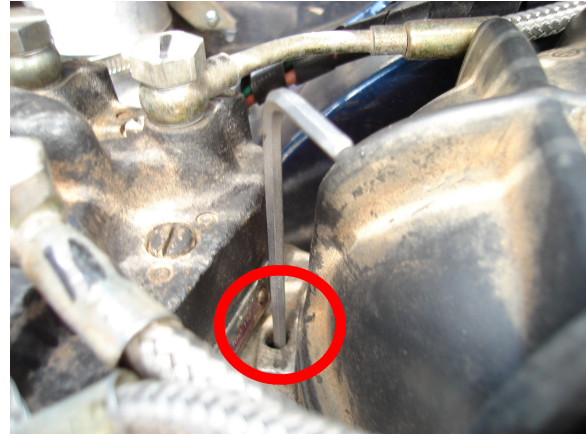
CO screw adjustment procedure:

A 3mm hex head is used to adjust the CO screw. The CO screw is basically an air fuel mixture adjustment screw. (See diagram at right) Adjusting the screw increases or decreases the amount fuel delivered for any given sensor plate position. Turning the screw clockwise will richen the mixture and counter-clockwise will lean out the mixture. **Be aware that small adjustments have a large effect on mixture and the screw changes the mixture at all operating points from idle to full power.** To obtain accurate readings the wrench must be removed and the engine must be accelerated after each adjustment of the screw.

4. Disconnecting the Lambda Valve

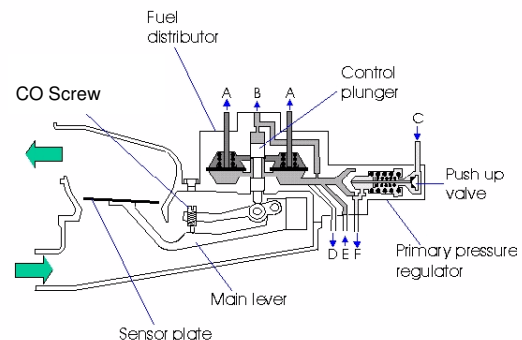
On lambda equipped cars (1980 and later), with a correctly operating lambda control loop, the air fuel ratio will always be close to stoichiometric (AFR = 14.7). If you are trying to tune a modified engine or tune for max power or max fuel economy we recommend you disconnect the electrical connector from the lambda valve.

WARNING: Disconnecting the lambda valve and operating the engine outside of stoichiometric may cause damage to a catalytic converter.



3mm hex head wrench installed in CO screw

NOTE: Remove the hex head wrench before accelerating the engine. **DAMAGE** may occur to the wrench or metering assembly if not removed.



Metering assembly and fuel distributor



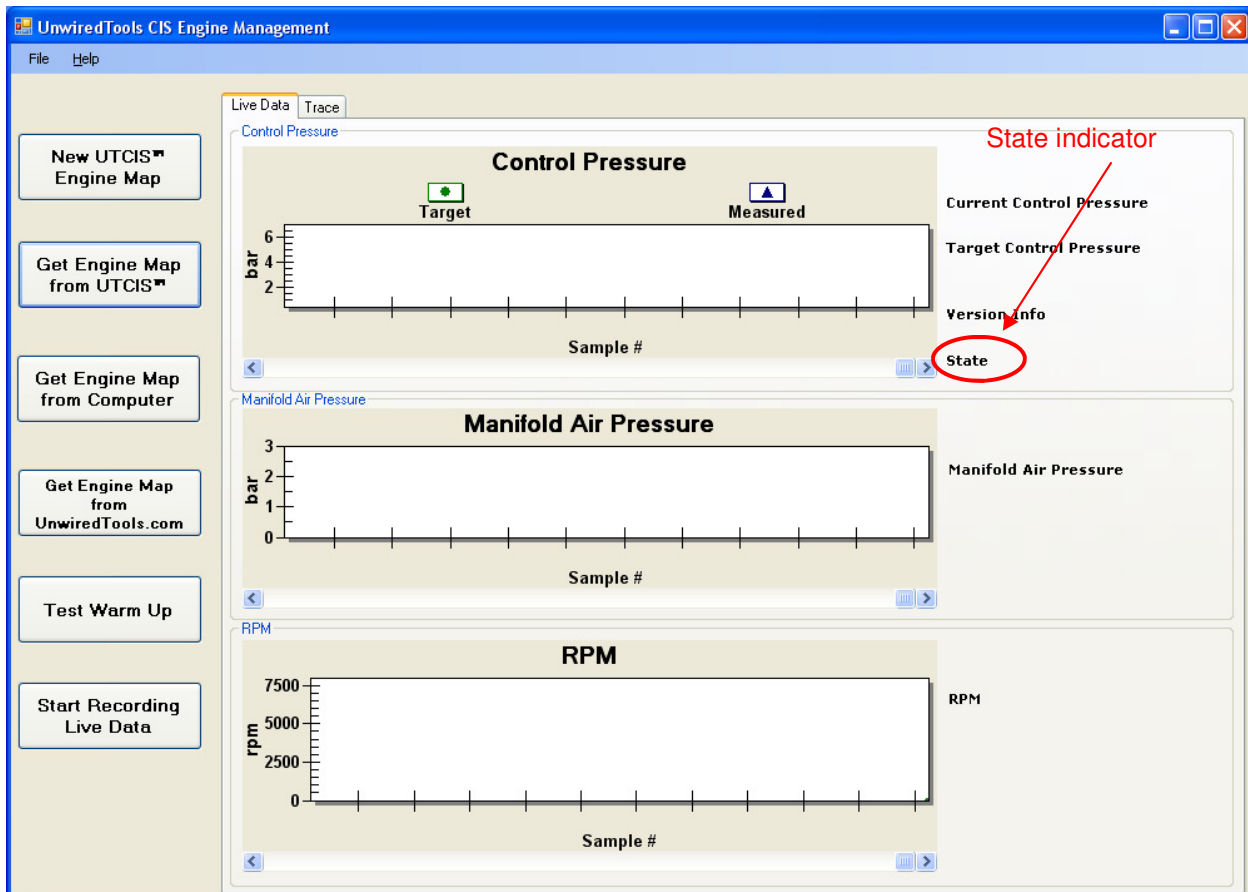
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Tuning Procedure

1. Bring engine to fully warm

Start the engine and let it reach normal operating temperature. **Do not drive the car or put the engine under load until you have completed step 2 of the tuning procedure.** Connect a PC to the UTCIS-V and open the UnwiredTools software. First, make sure it is out of warm-up mode. The State indicator should say idle or run. The Manifold Air Pressure should read 0.4 or 0.5 bar. If it reads 0.6 bar or higher check the vacuum connection to the UTCIS-V. Also be sure there are no vacuum leaks. If the UTCIS-V is connected to a good vacuum source and there are no vacuum leaks try increasing the idle speed a small amount. If that does not work and you have a performance camshaft see page 8 of this document. If the engine is idling and the manifold pressure is 0.4 or 0.5 bar you're ready to start tuning.



Screen shot from UT engine management software

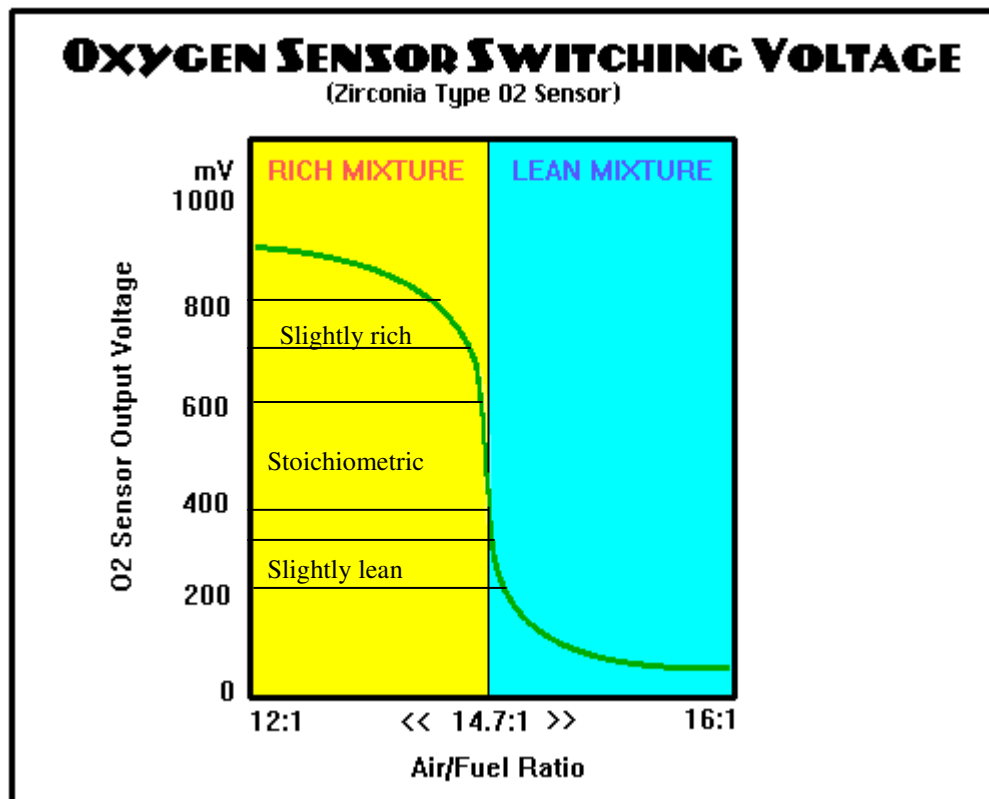


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2. Adjust the CO screw at idle

Check the volt meter for a reading from the oxygen sensor. If you are attempting to obtain maximum fuel economy then adjust the CO screw until you obtain a 200 to 300 mV reading from the oxygen sensor at idle. If you want good off idle throttle response and good acceleration adjust the CO screw to slightly rich, 700 to 800 mV from the oxygen sensor at idle. If you are looking for best economy then adjust the CO screw to obtain a 400 to 600 mV reading from the oxygen sensor. It is difficult to obtain a constant voltage in this range but you will know when you are at stoichiometric when the voltage on the meter jumps back and forth between lean (200mV) and rich (800 mV). The plot below shows oxygen sensor output voltage vs air fuel ratio.





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3. Tune the car under light load

With the volt meter on and connected to the oxygen sensor start driving the car. Under light the load the manifold pressure usually reads between 0.6 and 0.7 bar. This includes flat driving on the freeway and light acceleration around town. In general when the engine is under light load there are a few different conditions you may want:

Slightly lean => Good Fuel Economy => Oxygen sensor output between 200 and 300mV

Slightly rich=> Max Power => Oxygen sensor output between 700 and 800 mV

Stoichiometric => Good power/economy compromise => Oxygen sensor output between 400 and 600 mV

A. Engine is too lean under load - Meter reads less than 200mV

If the volt meter reads a voltage less than 200mV under load you will need to decrease control pressure. Using the UT Engine Management Software, decrease control pressure at 0.6 and 0.7 bar manifold pressure until you receive the mixture you want under load. Leave the control pressure at idle (manifold pressure equals 0.5 or 0.4 bar) alone. If you have lowered control pressure by more than 1.0 bar and the engine is still too lean try using the CO screw to richen the idle slightly. This should help bring the mixture to where you want if lowering the control pressure is not enough.

B. Engine is too rich under load - Meter reads greater than 850 mV

If the engine goes rich under load you will need increase the control pressure at 0.6 and 0.7 bar manifold pressure. Leave the control pressure at idle (manifold pressure equals 0.5 or 0.4 bar) alone. If you raise the control pressure to 4.0 bar at 0.6 and 0.7 bar manifold pressure and the mixture is still too rich try and leaning up the idle mixture with the CO screw. This should help bring the mixture to where you want if raising the control pressure is not enough.

C. Mixture is right where you want it

In this case just simply leave the control pressure alone at 0.6 and 0.7 bar manifold pressure.

4. Tune the car under heavy load

With the volt meter on and connected to the oxygen sensor start driving the car. Under heavy load the manifold pressure is usually between 0.8 and 1.0 bar. This includes heavy footed acceleration and climbing steep hills at high speed. This is the area of focus for this section. In general you will want to avoid a slightly lean condition under heavy load. Most performance and even stock engines will not react well to a lean condition under heavy load. Pinging and high operating temperatures are common when an engine under heavy load is run lean. The tuning procedure is the same as above A, B and C except you will now be adjusting control pressure between 0.8 and 1.0 manifold pressure. It is very common to adjust full throttle mixture to slightly rich even if you are trying to obtain maximum fuel economy. This is done by decreasing control pressure even further at 1.0 bar manifold pressure. This allows for good power when it is really needed.



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UTCIS-V and performance camshafts

Tuners have long struggled to get CIS to work well with long duration radical camshafts. The problem occurs at idle when a poor vacuum signal and intake manifold pressure pulses cause the metering plate to flutter. If this flutter is severe enough the metering plate can bottom out and temporarily shut off fuel to the injectors. It can also cause the mixture at idle to fluctuate to a point it becomes noticeable. The UTCIS-V has features which allows CIS fuel injection to work with long duration, high overlap camshafts. The steps to help CIS function with a high overlap, long duration camshaft are:

1. Lower the warm control pressure setting across the board (manifold pressure = 0.4 to 1.0 bar) by 0.5 bar to not less than 3.0 bar at idle. The engine will be very rich at this point and a helper may be need to keep the engine running.
2. Adjust the CO screw to bring the idle mixture to slightly rich. (oxygen sensor output = 600 to 800 mV)
3. Increase the idle slowly until the manifold air pressure is stable at 0.4 or 0.5 bar.
4. Lower the warm-up-cycle control pressure by 0.5 bar at all temperatures to compensate for the lower running control pressure.

This process allows the metering plate to require less force to respond to the weak vacuum signal produced by a performance camshaft at idle.

Note: If the manifold pressure at idle is unstable and manifold air pressure is 0.6 bar or higher then drivability problems will result. If this condition occurs then on acceleration the manifold air pressure will decrease before it increases. This will cause the fuel injection system to incorrectly lean out the mixture just off idle, causing a hesitation, “hiccup” or stalling. The longer the camshaft overlap and duration, the higher the idle RPM will have to be to have a stable vacuum (low MAP) at idle.



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Important Tuning Procedure Notice for UTCIS-PT™

For Porsche Turbo, 1989-93, aka Porsche 964

Note: This procedure requires a wideband AFR gauge



The '89 and later Porsche Turbo uses a revised fuel distributor design which limits the fuel pressure exposed to the Warmup-regulator, through the control pressure circuit, to not more than 4.0 bar. Earlier models used a simple orifice in the fuel distributor between the control pressure and system pressure circuits. The limitation of 4.0 bar in the later models may be due to the higher system pressure in these later models to prevent damage to the Warmup-regulator.

When the UTCIS-PT is installed on these later cars it is very likely that a control pressure of greater than 4.0 bar may be needed to raise the AFR at idle to near 14.. Tuners will find that the UTCIS is incapable of raising the control pressure above 4.0 bar no matter how high the control pressure is set in the UT Engine Map. This problem will limit the range of control of the AFR by the UTCIS

To restore full adjustability to the fuel system using the UTCIS on these later models UT suggests the following procedure:

1. Start the car and allow it to warmup while idling. Disconnect the RPM input to the UTCIS to force the UTCIS to use only the base map (1000 rpm map). The car can idle while the following steps are performed.
2. Change the idle control pressure to 3.9 bar. The idle will be irregular so the control pressure on the base map should be changed to 3.9 bar for 0.4 though 1.0 bar of MAP. Note the control pressure setting at these MAP values so you can restore them later. The idle will be very over-rich and rough at this point.
3. Using the 3mm CO adjustment screw in the air metering plate, raise the idle AFR to a lean value of approximately 17. This should be no more than one turn.
4. Return the control pressure of the base map back to the previous value, approximately 3.5 bar at MAP=0.4. The idle AFR should now lower to about 14 and the UTCIS will now have a full range of control. At this point you can set the idle control pressure to the desired AFR value and a control pressure setting of 4.0 or higher will not be needed.

Note: If the RPM is not reported correctly through the UT Engine Management Software then contact us for an upgrade or an RPM Signal Adapter.



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Contributors

A number of individuals have offered valuable feedback and tuning guidance for various makes and models of UTCIS™ applications. Contributors listed alphabetically.

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