

EMS Installation Instructions

The EMS 1 and EMS 2 are functionally identical, except for the CLD function (Coolant Level Detection), thus their installation is similar.

FITTING

You can use any combination of senders with your EMS – those functions that you do not use can be disabled within the menu structure.

When doing the wiring for the unit it is critical that you fit the black earth wire to the engine block – failure to do so will possibly result in erratic readings as other loads are switched on such as lights, fans, indicators etc.

Wire sizes used can be the same as the wires used on the harness supplied. Ensure that all connections are mechanically and electrically secure. Do not solder connections as these can lead to breakages were the solder stops due to the rigidity of the soldered joint.

Crimp terminals or twisted wire joints should rather be used.

Harness wires supplied WILL be too short to reach all the points, extra wire will be needed except for the EGT probe which has a 2.2 meter long lead.

FITTING SENDER UNITS

Notes to Remember

Apply Loctite thread sealer to pressure and temperature fittings – thread tape may cause electrical connectivity problems

All temp senders and pressure senders and EGT probes use the same 1/8"-27 NPT thread

Generally, adapter kits require NO DRILLING or TAPPING, if your engine does not have an adapter listed, check the text to see if it should then be tapped. Your MadMan supplier or local mechanic should be able to offer this service for a small fee.

Some engines make use of M10x1 threads or 1/8" BSP female threads on the oil pressure switch port – it is possible to safely fit the 1/8 NPT brass male Tee piece directly to this thread.

EGT - Exhaust Gas Temperature

Some vehicles make use of an EGR (Exhaust Gas Recirculation) system or have removable plates on the exhaust manifold for this purpose – if this is the case then the plates can be removed and tapped to accommodate the EGT probe. Your MadMan supplier should then also have this plate in stock as a listed adapter for that engine.

If you have an EGR valve fitted, remove it entirely and disable the diaphragm by removing the wiring loom or vacuum pipe. Use this port of the exhaust for the EGT.

If you do not have a port on the exhaust manifold or do not want to disturb it, you will need to drill and tap the manifold.

The manifold should be drilled at any suitable point closest to the entrance to the turbo, but still in the manifold, not the turbo housing.

With the engine cold, and idling, drill a pilot hole (4mm) into the manifold – as soon as the drill enters the inside of the manifold, the exhaust gas will escape past the drill bit ejecting the drilling swarf – guard your eyes.

Now drill the hole to 9mm, and immediately thereafter, tap the hole to the required thread (1/8 NPT)

The 1/8" NPT thread is a taper thread where the hole gets larger the deeper you tap it, generally the tap should be turned in until 3mm of the thread of the tap remains outside the hole – you can screw the sender in to check for a good fit.

Fit the brass compression fitting to the adapter plate/manifold and tighten the adapter into the manifold/plate with the hex nut section closest to the manifold/plate, leaving the clamping nut (closest to the probe cable) fitted but loose.

Ensure the "olive" is fitted beneath the clamping nut on the compression fitting.

Now tighten the clamping nut a bit until the probe is just nipped tight and it cannot move – tighten it another 1/8 turn. Note: it may be necessary to hold the fitting with a second spanner to prevent it from turning deeper into the manifold.

It is better to have it too loose and need to tighten it a little more than to overtighten it and break it off.

The braided cable should not be cut as it is very difficult to clean the cable to get to the wires. It is best to roll up the spare cable and tie it up – if both ends are already fitted then roll it in a figure "8" which is easier.

The cable can be lengthened using regular copper wire provided the joint is behind the dash and not in the engine bay as the accuracy of the probe will be affected.

MadMan can supply special cable to lengthen the probe without loss of accuracy.

Any loss will be the difference in temperature between the joint in the cable and the location of the EMS unit.

COOLANT TEMPERATURE

Notes to Remember:

The body of the temperature sender must form an electrical return path to the engine block (for single connector temperature senders)

The temperature sender should preferably be on the hot side (head side) of the thermostat

The temperature sender should always be in contact with water – no water means no temperature measurement, hence the need for the coolant level detector. A low temperature reading does not mean there is water.

There are several ways to fit the temperature sender:

In a spare coolant plug/probe

In a specially made sandwich adapter

In an inline metal adapter tube

Directly into a drilled and tapped hole in the aluminium/steel coolant piping/housing

Some engines have unused temperature measurement ports or unused blanked off holes.

These are ideal to use for the temperature sender – check your vehicle's installation details on the MadMan web site to see if a plug adapter is available – if we do not list one and you have a spare plug port, please contact us so that we can supply the appropriate adapter – free of charge.

Some engines do not have any spare ports so we have developed the sandwich adapter which bolts between the water inlet/outlet pipe and the block/head. The sandwich has a port in it to take the temperature sender. Check your vehicle's installation details on the MadMan web site to see if a plug adapter is available. If we do not list one, we have either not developed one for your engine yet or it cannot use a sandwich adapter. Either way, please contact us so that we can supply the appropriate adapter – free of charge.

Some engines have no option of a plug adapter or a sandwich adapter, these engines need an inline metal tube adapter or direct drilling and tapping.

The inline metal tube adapter is a short length of tubing with a port welded to it and an electrical tag.

A piece of the top coolant hose is cut out and this adapter is inserted in the space, the hoses are clamped to the tube and the temperature sender screwed in. The tube is then earthed to the engine block. Please contact us if you have a need for this type of adapter.

We will need to know what the inside diameter of your coolant hose is.

Some older engines had large open spaces where it is easy to drill and tap the cooling jacket to fit the probe. Firstly establish that there is enough free space inside the water cavity to accept the length of the temperature sender (30mm) before drilling.

Drill a pilot hole (4mm) into the metal surface – as soon as the drill enters the inside of the cavity, water will escape past the drill bit ejecting the drilling swarf – guard your eyes.

Now drill the hole to 9mm and immediately thereafter, tap the hole to the required thread (1/8 NPT)

The 1/8" NPT thread is a taper thread where the hole gets larger the deeper you tap it, generally the tap should be turned in until 3mm of the thread of the tap remains outside the hole – you can screw the sender in to check for a good fit.

OIL TEMPERATURE

You can choose to monitor either engine oil temperature OR gearbox oil temperature. Should you want to measure both, you must fit a SPDT (Single Pole Double Throw) switch to switch between the two senders as the EMS unit can only accept one oil temperature input at a time.

If you are already reading EGT, oil pressure and coolant temperature you may want to rather monitor transfer box temperature as these run rather hot.

If you have an automatic gearbox you **MUST** monitor auto gearbox oil temperature as these can overheat easily when towing.

We make use of plug adapters for most gearbox temperature measurement.

Please check your vehicles installation details on the MadMan web site to see if a plug adapter is available for your gearbox or engine sump. If we do not list one and your application can use this type of adapter, please contact us so that we can supply the appropriate adapter – free of charge.

Some ZF automatic gearboxes will accept a 1/8 NPT temperature probe directly into the original drainplug hole.

OIL PRESSURE

Most engines use an oil pressure switch, which is coupled to the oil pressure warning light on the dash display.

Locate this switch on the engine (often nearby the oil filter) and remove the connector and then the switch.

Some engines make use of M10x1 threads or 1/8" BSP female threads on the oil pressure switch port – it is possible to safely fit the 1/8 NPT brass male Tee piece directly to this thread.

If the thread is larger, check your vehicles installation details on the MadMan web site to see if an adapter is available – if we do not list one, and you think you need one, please contact us so that we can supply the appropriate adapter – free of charge.

You will need to fit the original pressure switch as well as the oil pressure sender to the engine by using a brass Tee piece (available from MadMan) You will need to see which one must be fitted first such that everything can be screwed in tightly. If there is no way that the original pressure switch and new pressure sender cannot co-exist in the space available there are two options: There may be an adapter pipe available that will effectively move the port away from the engine block to make space for the Tee piece, pressure switch and sender or

You can contact us to provide you with a pressure sender that contains both the pressure switch and pressure sender in one unit, which may be easier to fit.

COOLANT LEVEL DETECTION

The brown wire in the EMS unit connects to a coolant level sensor. EMS units with blue key pads (EMS2 models and EMS1 models with a firmware version lower than version 1.10) use an external device to measure coolant level such as the CLD Lite or a mechanical float switch. EMS1 models with firmware version 1.10 and higher (Silver keypad) have a built-in CLD unit.

The CLD unit (either EMS1 built-in or CLD lite) uses two probes (self tapping screws) and the presence of water/coolant between them to measure water.

The CLD unit is suitable for plastic coolant tanks, plastic radiator header tanks and can also be installed in the same inline metal adapter tube as for the coolant temperature sender.

For steel header tanks or copper radiators the mechanical float switch (MCLD) can be used.

CLD Installation in a Plastic Coolant Tank: See option A and B on the drawing

Select a suitable place on the plastic coolant bottle / plastic tank that is normally flooded with coolant – choose a spot about 10 to 20 mm lower than the normal level

Drill two small holes (1.5mm) about 25mm from each other in the same horizontal plane.

Fit small lugs to the brown wire from the EMS1 or purple wire on the CLD unit and screw the lug to the tank using a 3.5mm self tapping screw. The hole must be small so that the screw is tight – It makes a good water tight seal.

EMS CLD: Fit a lug to a loose black wire and screw that into the other hole, take the black wire to the same earth point on the engine block as the EMS earth.

CLD Lite: Fit the grey wire from the CLD to the other screw.

CLD Installation in an in-line steel pipe: See option C on the drawing

Some vehicles have no way of fitting a mechanical float switch and do not have plastic components, these vehicles can use an inline steel pipe in the radiator hose.

Select a suitable place in the top coolant hose, close to the engine block that is normally flooded with coolant.

Cut the hose here and insert the steel pipe and refit the hose to the other side of the pipe with clamps.

Fit the brown wire from the EMS1 or purple wire from the CLD Lite to the pipe.

EMS CLD: The return path is via the EMS earth wire already installed – no further wiring necessary.

CLD Lite: Connect the grey wire to the engine block.

Mechanical Float Switch Installation:

Drill a suitable hole in the metal tank, feed the wires through the hole, ensure that the sealing washer is fitted and tighten the nut, slowly and consistently until it feels tighter than before, then turn it one flat more – if it leaks turn it another flat tighter.

The float switch has two black wires, connect any one of these to the engine block and connect the other to the EMS1 or EMS2 wire directly.

The CLD Lite has a built in 5 second delay after water loss before it makes the alarm, this is to prevent false alarms when the water sloshes about in the container.

When the EMS2 unit is used with the CLD Lite, the EMS coolant alarm delay should be set to zero. If the mechanical float switch is used the EMS should be set to 5 seconds or any suitable value to prevent false alarms – the shorter the delay the better the safety margin.

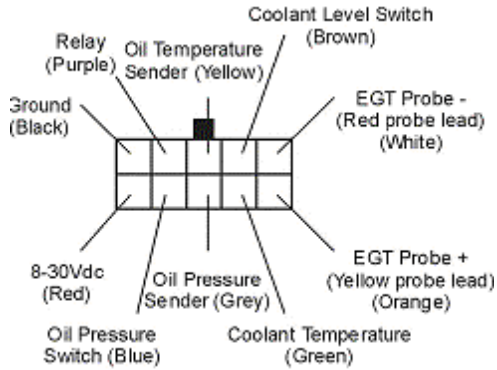
TURBO BOOST PRESSURE

If you choose to use the VDO 0-2 Bar (0-30 PSI) boost sender then you will need to change the EMS settings a little:

PRESSURE TYPE: BOOST
SPAN: (you choose from zero to 2 Bar)
TOPSCALE: OFF
ALARM LOW VAL: 0
ALARM LOW: OFF
ALARM HIGH VAL: (You choose)
ALARM HIGH: OFF
SENDER MAX Ω : 180 Ω
SENDER MAX PR: 2
SENDER DIR: INC
PRESSURE UNIT: BAR
PRESSURE SWITCH: NO
PRESS SENDER: VDO

DRAWINGS

Both EMS versions use the same connector as follows:



Connector Colour Coding:

EMS Wiring
Red – 8-30V DC
Black – Ground – Engine Ground
Purple – Relay contact
White – EGT Probe – (Red probe lead)
Orange – EGT Probe + (Yellow probe lead)
Yellow – Oil Temperature Sender
Grey – Pressure Sender Input
Blue – Oil Pressure Switch
Green – Coolant Temperature Sender
Brown – Coolant Level Switch

Automotive Senders

Oil and Coolant Temperature:

VDO Temperature Sender 50-150 Deg C (122-302 Deg F)

VDO Part Number VDO323/801/009/001c

Oil, Fuel or Aux Pressure:

VDO Pressure Sender 0-10 Bar (0-145 PSI)

VDO Part Number VDO360/081/029/012

Tee Piece (For oil pressure sender)

1/8" NPT Running Tee (M-F-F)

Turbo Boost Pressure:

VDO Pressure Sender 0-2 Bar (0-29 PSI)

VDO Part Number VDO360/081/032/025

Thermocouples:

TP 40 – 40mm x 6 K type thermocouple probe with a 2.2 meter (7.2 ft) Stainless steel braided lead and a 1/8 NPT Brass Compression fitting

TP 60 – 60mm x 6 K type thermocouple probe with a 2.2 meter (7.2 ft) Stainless steel braided lead and a 1/8 NPT Brass Compression fitting



