Notes For Fitting A New EPROM Chip Into A Lucas 14CUX ECU.

PRECAUTIONS BEFORE YOU START WORK.

Please take the trouble to read these notes, which are provided to help you obtain a successful installation. The notes should be read completely before starting work, as some time spent now could avoid tears later! It is not our normal practice to provide EPROM chips for self-fitting except in exceptional circumstances, since the results cannot be guaranteed. Self-fitting is performed entirely at your own risk. This information is provided for your guidance, and whilst every care has been taken it is not guaranteed to be error free or totally comprehensive.

The ECU (Electronic Control Unit) is easily damaged by Static Electricity (ESD or Electro-Static Discharge). Therefore you need to use extreme care when working inside the ECU. If you do not have the correct facilities then the risk can be reduced by working on an earthed metal workbench (a stainless steel sink draining board fits this description!), or a large sheet of aluminium kitchen foil. Avoid wearing man-made fabrics whilst performing this type of work if possible, since they tend to generate Static Electricity (suggest cotton or wool clothing).

Please note that the EPROM and its decoder board are not covered by warranty in case of ESD damage, or incorrect fitting (especially plugged in the wrong way around). A small charge is made for replacement in these cases.

Never disconnect the ECU whilst the ignition is switched on, and especially not while the engine is running. Never work on the ECU whilst it is plugged in, since this system runs continuously (performing diagnostics) even when the ignition is switched off. If anything is unclear then please do not hesitate to contact your supplier. There's no such thing as a silly question, except the one you didn't ask although you needed to….

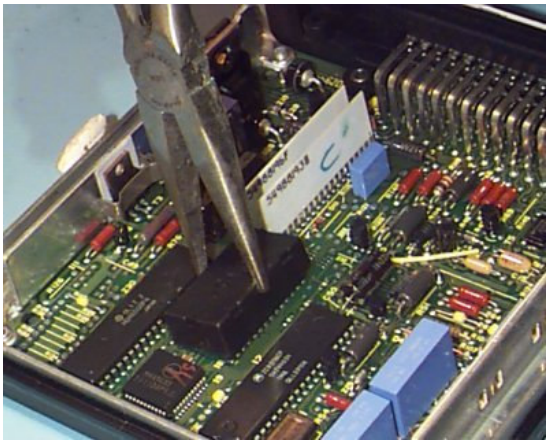
FITTING INSTRUCTIONS.

Ensure that the vehicle ignition is switched off, and disconnect the vehicle battery. Unplug and remove the ECU from the vehicle. The ECU is unplugged by pressing down the retaining clip by the connector (opposite end of connector to where the loom enters it), and swinging the opposite end away from the ECU body.

Remove the lid of the ECU by removing the four TORX T20 M4 screws that secure it. Identify the EPROM chip using the diagram for assistance. Pay particular attention to the orientation of the chip – pin one is usually marked by a notch in one end of the chip as shown in the diagram.

If the EPROM chip is already fitted in a socket, then it will probably have a black plastic cover over it with the word LUCAS moulded on to it.

The cover must be removed with pliers as shown in the picture on the right. Note that the pliers are used to grip the cover firmly at least half way up the sides, to avoid pinching the socket underneath. It may be necessary to rock the cover gently from side to side several times in order to release it from the circuit board – be patient and take your time!



Now the EPROM itself may be removed as follows, again as shown in the picture on the left. Gently lever it out by placing a thin screwdriver blade between the chip and socket, and rotate the tip to prise it out.

Take great care not to bend the pins of the old EPROM as it comes out. Be very careful to avoid damage the circuit board or socket underneath.

Where the existing EPROM is soldered in, it must be removed and replaced by a socket, which is really a specialist job. As such it should be entrusted to someone experienced with the correct equipment, since it is very easy and expensive to damage the circuit board. Any mistakes here are definitely your problem!

The crudest method is as follows, entirely at your own risk. Individually cut all the legs of the existing EPROM chip where they enter its body, and then pull out the body. Do not lever between the chip and circuit board since the circuit tracks are easily damaged. Heat each of the remaining legs with a soldering iron from underneath the circuit board and pull them out individually. Clear out the old holes with a solder sucker and clean the board. Insert the new socket and solder it in. The exposed joints should be treated with conformal coating to prevent problems with condensation in cold or humid conditions.

A new EPROM chip must be fitted the same way round as the one it replaces, or else it will probably be destroyed (fry and die!). The decoder board and the EPROM chip are marked with a red paint spot by pin number one, in addition to any manufacturer's markings.

The fitting order of the components is as follows. The green decoder board fits into the socket on the ECU circuit board, and the EPROM fits into the decoder board. When fitting the new EPROM chip into the decoder board, take time to ensure that all the pins enter the socket correctly. It is quite easy for one or two pins to fold underneath during insertion. The picture to the right shows the correctly fitted chip.

Ensure that the correct Tune Resistor is fitted to the vehicle. This will be marked on the ECU and EPROM chip labels, and varies according to application.

For North American Specification (NAS) vehicles there are some variations in the usage of a Tune Resistor. Sometimes there is a socket, but no Tune Resistor fitted. Alternatively it may be taped up inside the wiring loom, or may not be present at all. Please consult your supplier for

details if there is any doubt, since you will not be able to achieve proper operation without use of the correct Tune Resistor.

Now reassemble the case and stick the provided label onto the outside of the ECU case.

Refit the ECU into the car by reversing the removal procedure. When the ignition is turned on for the first time without starting the engine, the fuel pump will be heard to run for three seconds and then stop. This is a good sign at this stage!

SETTING UP AFTER FITTING.

After fitting, it will be necessary to set up the engine to suit the new EPROM. Firstly the general engine settings must be correct e.g. fuel pressure, ignition timing, spark plugs, throttle potentiometer idle voltage, etc. Then the idle mixture must be set (this is also true for catalyst cars although the procedure is significantly more complex). Follow the guidance of your engine supplier for these details – where no information is available then please contact us for details.

Recommended settings for ignition timing are as follows (vacuum advance disconnected whilst measuring): 8-12 degrees BTDC at idle, rising to 28 degrees BTDC at 4000 RPM. For non-catalyst cars, idle mixture should be between 2 and 2.5% CO. When adjusting this it is best to aim for the minimum value of Hydrocarbons (HC), which indicates the most efficient combustion.

It is useful to verify CO adjustment in the following manner. Peel back the rubber boot on the airflow meter connector and leave it plugged in to the airflow meter. Set up a digital multimeter to read voltage. Insert the negative probe into the Red/Black wire, and the positive into the Blue/Red wire.

Turn on the ignition, but do not start the engine. On this injection system, the idle CO mixture adjuster is provided on the airflow meter. It is located in a boss on the top of the airflow meter, pointing towards the engine.

Now turn on the ignition but do not start the engine. Observe the voltage. The normal adjustment range is between 0.0 and 3.6 Volts, with the higher Voltages producing higher idle CO values. There are approximately 20 turns of the adjuster screw to cover the entire range.

Annoyingly, the adjustment may be clockwise or anti-clockwise to increase the value, and this varies from meter to meter! For this reason it is always preferable to have the multimeter connected in this manner when adjusting idle CO, so that you can something is actually happening!

Typical Voltages that would be found at this point are between 0.9 and 1.3 Volts. A value near to 3.5 Volts will generally produce an idle CO value of 9-10%. For catalyst cars and standard vehicles then a value of 1.0 Volts is generally best for a standard vehicle, and 1.3 Volts for a modified one. These Voltages may be used as safe initial values particularly if no CO measuring equipment is available.

Finally it will be necessary to set the “Base Idle Speed” which is the speed the engine idles at when it is not controlled by the ECU. This operation is performed when the engine is at operating temperature, and all other adjustments are correct. The idle bypass hose between the Idle Speed Control Valve (on the back of the Plenum Chamber) and the throttle body is blocked off using corks or bungs. The engine is then started and the idle speed adjusted using the bypass screw located on the side of the throttle body. Base Idle speed is always clearly indicated on the ECU label that is supplied with your Tornado or Optimax EPROM.

Base Idle speed is heavily affected by ignition timing and idle mixture. If any of these things change then it is highly likely that the adjustment will have to be repeated. This can be considered to be a regular service adjustment.

It is important to understand that the Lucas 14CUX system is adaptive, and its idle (and mixture control for catalyst cars) behaviour will change over the first couple of hundred miles. This will always happen after the system has been disconnected or otherwise powered down.

Tornado and Optimax series EPROM chips provide full diagnostic capabilities, which are compatible with Land Rover fault code readers if required.

TROUBLESHOOTING.

Don't Panic! Your supplier can help you here. Most of the mistakes you can make have been made before. Just be honest and then we can help you. If there is any problem with the chip then it will need to be returned for inspection before it can be replaced.

1. **The fuel pump either doesn't run for three seconds, or runs continuously when the ignition is turned on.**
   Oh dear. The chip is probably plugged in the wrong way round, or one of the legs is bent underneath, or the ECU has been damaged during the process, or the EPROM/ECU is not plugged in yet.

2. **I plugged in the EPROM chip the wrong way round and realised after I switched it on.**
   In this case it is almost always the EPROM chip and/or the decoder that is damaged, not the ECU. The best thing to do here is confess, and a replacement can be issued at a reasonable cost upon return of the dead one. Both the EPROM and the decoder contain unique signatures that are destroyed by incorrect connection.

3. **Idle speed stays at 1100 to 1200 RPM despite setting the Base Idle speed correctly.**
   If the Base Idle speed did adjust correctly, then the usual cause of this problem is that the throttle potentiometer is not adjusted properly. If the Base Idle could not be adjusted down then there is an air leak, or the throttle butterfly is not correctly set up.

   The potentiometer can only be adjusted after the throttle body has been set correctly as specified by Land Rover. Using a digital Voltmeter, put the negative probe into the Red/Black wire (engine side of throttle potentiometer plug), and the positive into the Red wire. Start the engine and check that the voltage reading is 0.32 – 0.34 Volts. If it is not then slacken the mounting screws, rotate the potentiometer to achieve the correct reading, and then retighten. Note that some potentiometers do not have slots for the mounting screws, and in this case the mounting holes may need to be elongated to allow adjustment.

4. **Idle speed shoots up to 1800 RPM and takes at least 10 seconds to come down.**
   Usually this means that the Base Idle has not been set correctly. For catalyst equipped cars it may mean that either there is a defective oxygen sensor, or that the basic mixture adjustment is incorrect. Contact your supplier for specialist advice in this case.