

Electronic ignition and **rev counters**

Rod Shears explains how he overcame the problems that can be encountered fitting electronic ignition to some E-types

The remarkable six-cylinder Jaguar XK engine was manufactured for more than 40 years and all cars up until the last fuel-injected XJ6s left the factory with a mechanical contact breaker providing the essential sparks for ignition. The contact breaker was quite remarkable in its simplicity, in so far as it cost just a few pence to manufacture yet was capable of literally millions of operations.

Our six-cylinder E-type Jaguars would have all been equipped with a Lucas distributor containing a mechanical contact breaker, and many are still using this system. Additionally a number of cars have either had the contact breaker replaced with a solid-state ignition module or the entire distributor replaced with a modern type such as the Dutch 123 series, which can include the facility to programme the advance curves through either a USB port or mobile phone Bluetooth connection.

Why replace a contact breaker with a modern alternative? The reason is simply reliability and efficiency, although the owner seeking total originality may not share this view. The remarkable contact breaker is, however, when correctly set responsible for around six percent misfires! No not misfires as if you had pulled a plug lead off, but incomplete combustion – ie, the mixture is lit but not as well as it could

be, hence the initial burn is slow, resulting in unburnt fuel entering the exhaust system and eventually the atmosphere.

These poorly lit cylinder cycles can manifest themselves as an erratic idle, although mixture and valve condition can cause this too. In this writer's experience, every car that was converted to electronic ignition showed an immediate improvement in idle, engine response and subsequent fuel consumption. Regarding reliability, electronic devices tend to fail either within the first hours of operation or in the very long term through physical breakdown of the package enclosure allowing mechanical failure of the internal connections, although these days this is rare. The modern car is totally electronic-system dependant so we should not be concerned about one small component in our E-types when the gains are so real. Irrespective of the make, all electronic ignition systems will show marked improvement

- Above: the finished assembly ready for installation. Note the 6,500rpm rev counter rather than the usual 6,000rpm unit



- Left: the original circuit board after being removed from the rev counter

The electronic components used for this instrument are about as cheap and as few as you can get. Furthermore, the energy in the ignition pulses varies with engine speed, hence the instrument is not perfectly linear. It is probable the instruments were calibrated around 2,000 or 3,000rpm, with accuracy deteriorating at the extremes. Modern rev counters work in a similar way in so far as they count ignition pulses either digitally or by at least standardising the pulse width first, hence they are more accurate and do not require a high current ignition system to operate.

There are automotive instrument repairers that offer to convert the rev counters so that they are compatible with electronic ignition. This will require removing the instrument and sending it to the specialist. Alternatively, if you are into the hands-on approach, as many owners are, you can convert it yourself for a few pounds, and pleasingly the end result is a more accurate, stable instrument.

The writer's car is his fourth E-type, this one imported from Texas in 2017, and has been subject to a full, largely hands-on, restoration currently nearing completion (more of which to follow). Making the rev counter work with a 123 distributor was among the many challenges faced during the restoration. The rev-counter modification does not rely on any fancy new design work, but simply substituting the circuit board from a modern 2in-diameter instrument. The good bit is, the donor instrument cost less than £15 (available on eBay) and the quality of the circuit board and components are high computer grade, unlike the transistor radio junk used in the original.

Firstly, the rev counter must be removed from the car, and if you attempt this from under the dashboard it will be a real struggle. Far easier and in the long term quicker and safer is to remove the top cover by undoing the two nuts at each end and the two in the centre that are accessible by lowering the centre instrument panel. Replacement is the reverse order and perhaps the fiddliest bit will be locating the demist hoses back into the demist outlets.

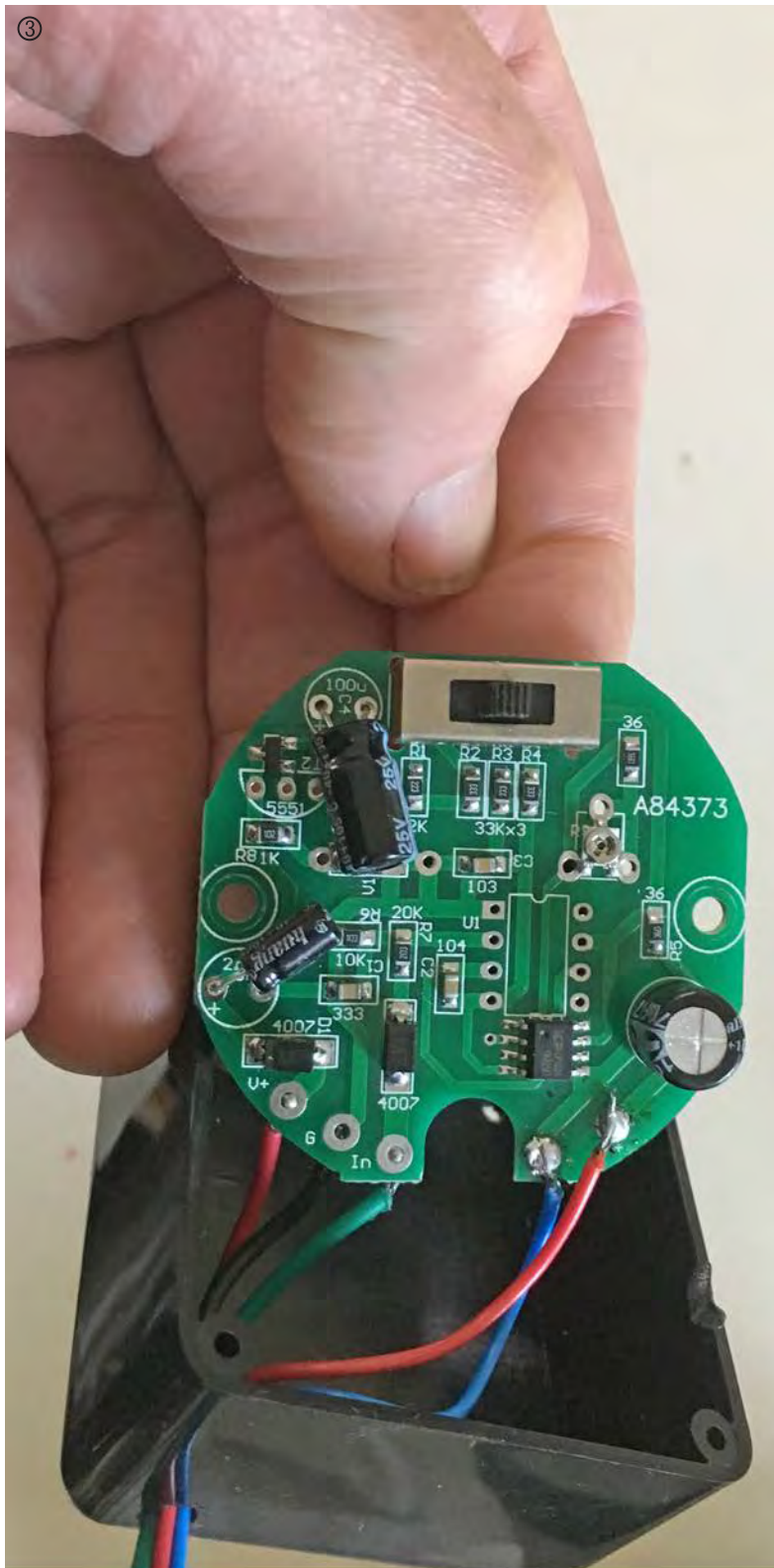
Once the cover is removed, the clamps holding the rev counter in place can be undone and is easy to see what you are doing from the top. Apart from the illumination lamps, which just pull out from the back, the electrics are on a plug that should be pulled out from the back of the instrument.

The instrument can now be opened, and to do this the bezel and glass are removed by rotating the bezel until the tags line up with the slots on the case. If it's never been apart, you may have to ease the tags upward with a

over a contact breaker. Modules that fit inside the Lucas distributor in place of the contact set can be bought for as little as £30, whereas a new programmable distributor will cost around £400. Fitting and setting up takes a couple of hours.

Some cautious owners have converted their distributors by fitting an electronic module but prefer to carry the old contact breaker in case of failure. Trying to set up a contact breaker on the roadside would not be a lot of fun, and on the hard shoulder would be suicidal! Sticking with the old contact breaker carries a far higher risk of breakdown than fitting a modern electronic alternative. Carry a spare by all means, but the chances are you will forget it's even on board.

Converting to electronic ignition on later E-types can cause problems with the rev counter in so far as it may not work at all. The problem with the rev counter not working with electronic ignition will occur with late cars. Earlier cars fitted with a tachometer driven from the back of the camshaft will not be affected. On later cars, the rev counter contains a current transformer that has the coil positive feed wire running through the core of the current transformer. Every time the contact breaker operates, a hefty current pulse from the coil induces a voltage at the output of the current transformer. This voltage is effectively stored on a capacitor, the voltage of which is measured by the moving coil voltmeter, which is the instrument display that we read on the dashboard.



screwdriver before it will turn. Once the glass is removed, the rear screws can be removed, which allows the case to slide off. The circuit board which is to come out is shown in picture two. Cut the wires free, noting the two that feed the moving coil instrument. The moving coil requires two new wires that should be soldered in place and fed out through a hole in the rear of the case. Once these have been attached, the instrument can be reassembled and the old circuit board discarded.

The new 2in rev counter comes apart in a similar manner, and once apart the circular circuit board (picture three) can be removed by undoing the nuts and spacers securing it. There is a three-position switch on this circuit board that enables the selection of four-, six- and eight-cylinder engines; set it in the middle on 'six'. The red wire will be connected to


- Left: the donor circuit board, which was sourced from a modern 2in rev counter that cost less than £15 from a supplier on eBay

the ignition positive supply, the blue wire to ground, and the trigger wire will connect to the coil on the side that connects to the distributor module. The easiest way to accomplish this is to change the original wire at the coil to the other coil terminal, and insert the trigger wire into the otherwise unused rev counter free socket. A spade connector crimped onto the trigger wire fits the socket perfectly. The new circuit board is mounted into a small plastic box available from eBay and the wires between it and the instrument head need to be about 30cm long to enable it to be mounted below the dashboard.

Picture one shows the finished assembly ready for installation. Testing and calibrating can be accomplished before installation. Connect a 12-volt supply to the unit, and to calibrate you can use a low-voltage AC supply or a pulse generator. Most owners will not have access to a pulse generator but a transformer providing anything from six to 30 volts will work. In fact, some power supplies for rechargeable items provide an AC output. The AC output is connected to the negative ground supply and the trigger wire.

The AC output will provide a pulse of 50Hz that is 3,000 per minute. Our ignition system provides 3,000 pulses at 1,000rpm as the distributor turns once every two engine revolutions – one half turn is three sparks. To calibrate with everything connected, turn the potentiometer located at approximately 9 o'clock in picture three until the rev counter reads 1000rpm, that's it can go back in the car. If you are located in the USA or anywhere where the electricity supply is 60HZ, ensure you set the calibration at 1,200rpm not 1,000rpm.

Finally, the writer's car has a balanced and lightened engine, hence why the rev counter has a range of 6,500rpm (normally 6,000rpm on six-cylinder cars). Following installation, the rev counter was checked throughout the range with a pulse generator and no adjustment to the calibration was necessary. Quite an obscure modification overall but one that works well.

Next time we will look at importing a car from the USA. Meanwhile, good luck. 

Component suppliers Jaguar E-type AccuSpark performance Module Pack for Lucas 25D6 (eBay); AccuSpark Electronic Distributor with Screw Top for Jaguar E-type (eBay); Pertronix LU-166A Ignitor Electric Ignition Module Lucas 22D6 Jaguar E-Type (eBay); 123 Electronic Distributors (sales@sngbarratt.com); 2in 52mm Car Tacho Rev Counter Gauge Tachometer 0-8,000rpm (eBay); ABS Black Plastic Electronics Project Box Enclosure Hobby Case (eBay)