

CAR COMPUTER PART THREE

Our final article this month tells you how to fit the fuel flow and distance sensors to the vehicle, and describes how the Car Computer is operated. Also included is a listing of the EPROM program.

by JOHN CLARKE and GREG SWAIN

Before actually describing how the sensors are fitted to the vehicle, we should first point out that the Prince fuel flow sensor will not now be available with this kit. We learned of this situation shortly after the August issue went to press, and by that stage it was too late to make any alterations.

This means that kit suppliers will only be supplying the Moray fuel flow sensor, which is all to the good. As explained last month, the Moray sensor is the preferred unit as it allows a one second update time for instantaneous fuel consumption. The Prince unit, by comparison, was only good for eight second update times.

The way in which the sensors are fitted will be largely self-evident from the accompanying diagrams. Fitting is straightforward, although dirty hands and bruised knuckles are par for the

course when working with any motor vehicle. We suggest that constructors read this article carefully, as there are a number of important guidelines that must be followed.

Fuel flow sensor

The fuel flow sensor is fitted in the fuel line between the fuel pump and the carburettor — preferably after the fuel filter (see Fig. 1). It should ideally be mounted vertically, but if it has to be mounted horizontally it should be fitted with the fuel passage above the detector housing. The arrow on the side of the sensor must point in the direction of flow; ie, towards the carburettor.

In cars which use flexible hosing between the fuel pump and carburettor, it is simply necessary to disconnect the hose at the pump end (assuming a mechanical fuel pump with integral filter) and insert

the flow sensor in the line. If a metal fuel line is used, it will have to have a suitable length cut out of it. Remove the fuel line from the vehicle before cutting so that the ends can be satisfactorily deburred and any filing cleaned away.

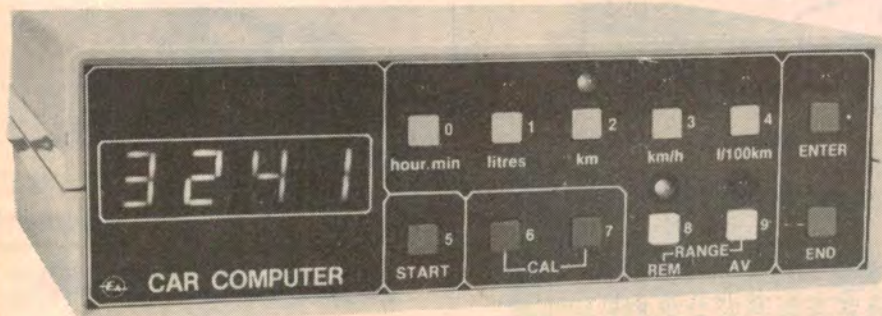
Use only genuine fuel line hose to make the interconnections to the sensor. Do not use nylon tubing or any other type of hose not designed for petrol, as it will become hard and prone to leakage within a short period of time. Secure each connection with a hose clamp to prevent leakage.

Because of its light weight, the Moray fuel flow sensor can usually be mounted suspended in the fuel line without the need for a supporting bracket. Avoid close proximity to ignition leads, and keep it well away from the exhaust manifold to avoid the possibility of vapour lock. You should also ensure that the sensor is correctly oriented, that all clamp connections are tight, and that the hoses are not kinked or stressed.

On vehicles fitted with a recirculating fuel system, the flow sensor should be fitted as shown in Fig. 2. A car with a recirculating fuel system is one in which petrol is not only pumped to the carburettor, but is pumped back to the fuel tank as well. If your car has a second pipe connected to the fuel line union at the carburettor, and which runs back to the tank, then it has a recirculating fuel system (see Fig. 1).

Fairly obviously, any fuel returned to the tank must bypass the fuel flow sensor otherwise we would get an incorrect reading of fuel usage. This problem is overcome by fitting a T-junction into the fuel line between the pump and the flow meter. The original return is then blocked off using a suitable brass plug secured by a clamp.

Make sure that the stem of the T-junction is used for the return to the



Car Computer can be mounted at any convenient location on or under the dashboard. Unit is easy to operate and calibrate. (see text).

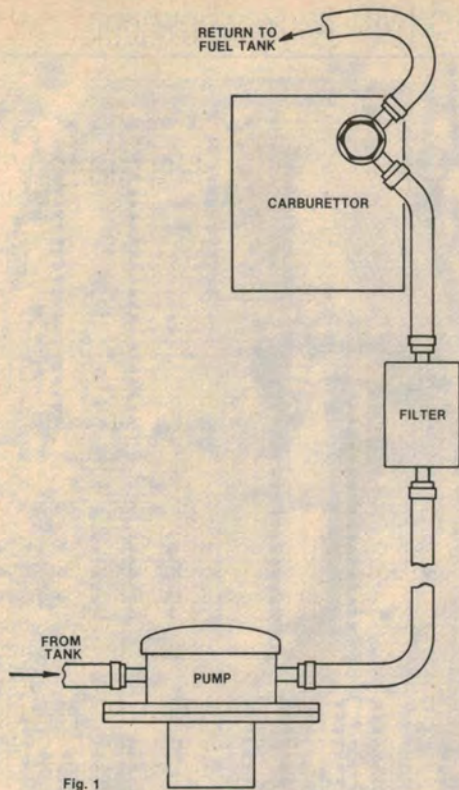


Fig. 1

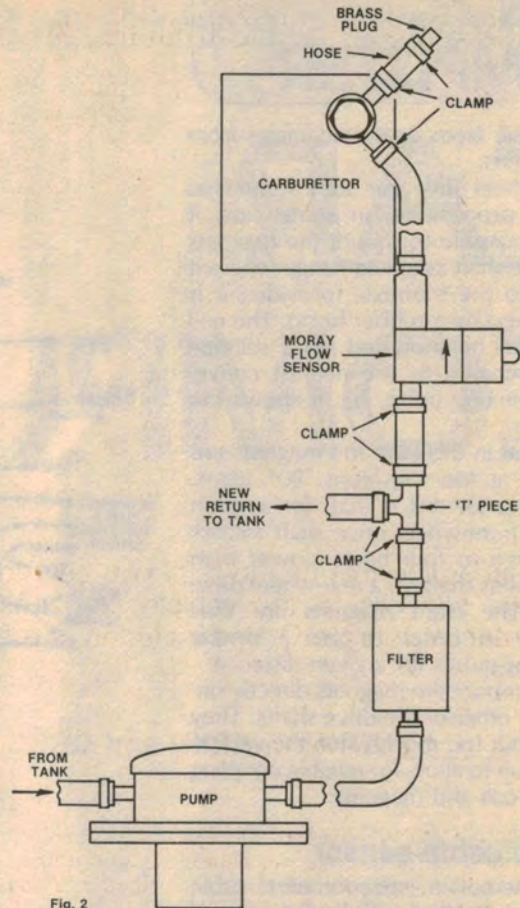


Fig. 2

Figs. 1 & 2: fitting the fuel flow sensor to a car with a recirculating fuel system. Mount the sensor vertically, with the arrow pointing in the direction of the flow.

tank, as this contains a restricting orifice which limits the return flow. On some cars, a T-junction is fitted between the pump and carburettor as standard, in which case the flow meter should be fitted after the T-junction.

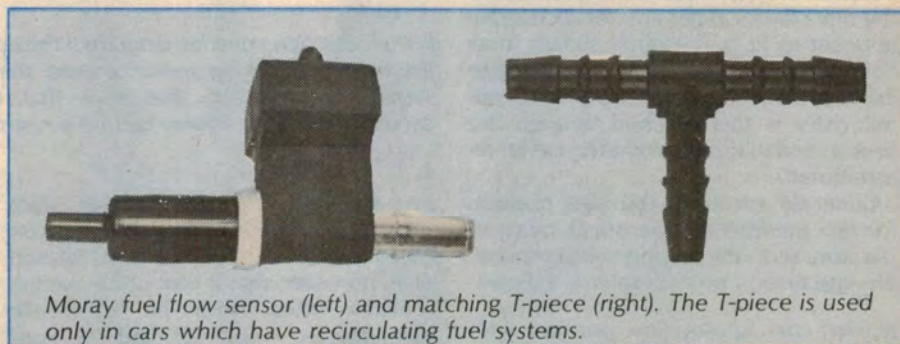
WARNING: some cars, such as the Holden Commodore, are fitted with a vapour recovery system employing a charcoal cannister. This is NOT the same as a recirculating fuel system, and on no account should you tamper with the vapour recovery line between the charcoal cannister and the carburettor. If in doubt, consult your local dealer.

Unfortunately, the Moray fuel flow sensor cannot be used with fuel injection or diesel engines.

Distance sensors

As stated last month, two different distance sensors can be fitted: (1) a magnetic pick-up using a coil and rotating magnets, or (2) a speedometer cable sensor. Generally, the magnetic pick-up system will suit most rear-wheel drive cars with a front-mounted engine, as the tail shaft is an ideal position for the magnets. It may also be possible to find a suitable position for the magnets on some front-wheel drive cars.

Figs. 3 and 4 show how the magnetic



Moray fuel flow sensor (left) and matching T-piece (right). The T-piece is used only in cars which have recirculating fuel systems.

pick-up sensor is installed in rear-wheel and front-wheel drive cars respectively. In the case of a rear-wheel drive car the sensor should be mounted as close to the gearbox as possible, where vertical movements of the tail shaft are minimal. The magnets are secured to the tail shaft using tie wire and epoxy adhesive.

We used four 15mm-dia round magnets in all, two mounted side-by-side at each position to compensate for any longitudinal movement of the tail shaft (see Fig. 3). Some kit suppliers, however, will be supplying 25mm-long bar magnets, in which case only one magnet will be required at each position.

The coil was mounted on an L-shaped bracket made from aluminium and

secured to the underside of the car using self-tapping screws. This bracket should be positioned so that there is a 10mm gap between the end of the coil and the magnets when they are directly opposite each other. Be careful not to damage any wiring cables running along the floor when drilling the mounting holes for the bracket.

Wiring to the coil can be run along the underside of the car, with the leads secured at various points as convenient. Do not connect the earth lead to chassis at the coil mounting position. Instead, we suggest that both the earth and signal leads be run as a twisted pair all the way back to the rear panel socket on the computer. Plastic tubing can be used to

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protect the leads against damage from flying stones.

Front-wheel drive cars are a somewhat different proposition. In some cars, it may be possible to mount the magnets on a drive-shaft coupling flange where it bolts onto the transaxle (provided it is not covered by a rubber boot). The coil could then be mounted on a suitable bracket secured to the nearest convenient mounting point. Fig. 4 shows the basic idea.

Note that in this case the magnets are mounted at four positions, 90° apart. The reason for this is that, for a given speed, a front-wheel drive shaft rotates about three to four times slower than the propeller shaft on a rear-wheel drive vehicle. The extra magnets are thus necessary in order to get a similar number of pulses for a given distance.

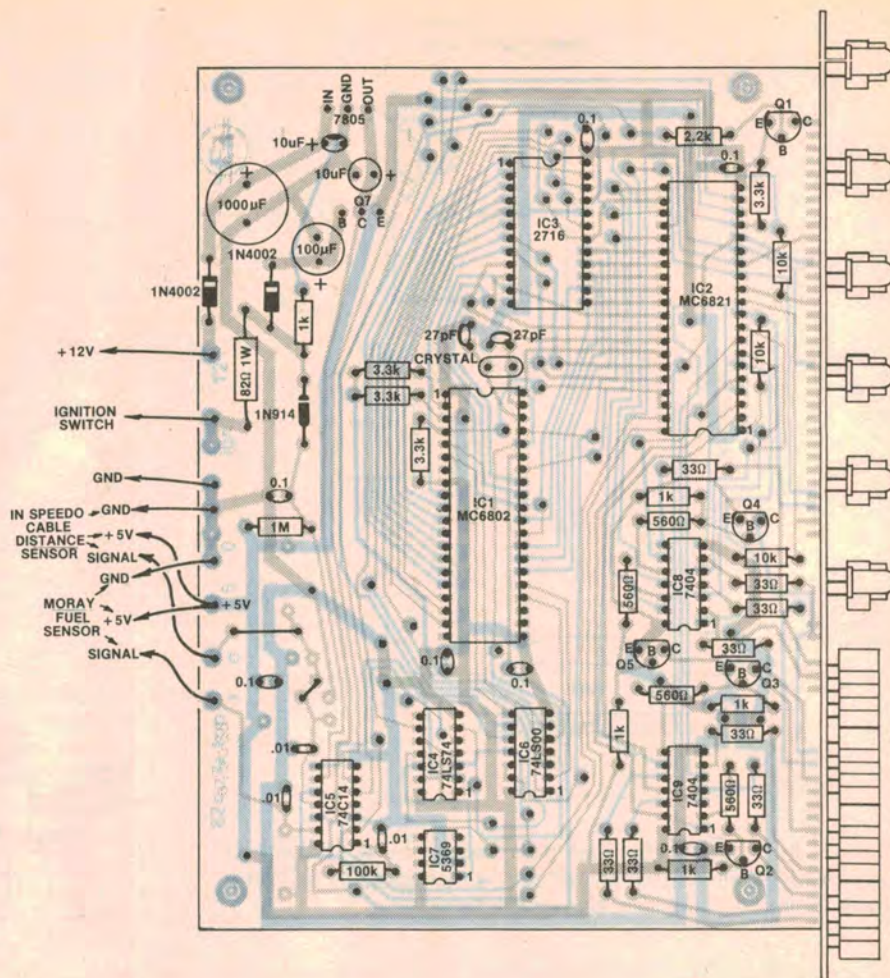
Do not mount the magnets directly onto one or other of the drive shafts. They move about too much when the vehicle is in motion to allow for reliable coupling between coil and magnets.

Speedo cable sensor

The alternative speedometer cable sensor can be used with both front and rear-wheel drive cars, but is mainly applicable to front-wheel drive cars where the drive shaft flanges are not accessible. In order to fit it, the outer sheath must be removed from the speedometer cable and cut at a suitable point. The inner cable is then pushed through the sensor and the speedometer cable re-assembled.

Generally speaking, the best position for the speedometer sensor is close to the firewall in the engine compartment. The installation procedure is as follows:

- Mark the appropriate position with white chalk, then remove the speedometer cable from the vehicle;
- Remove the retaining circlip and withdraw the inner cable;
- Using a hacksaw, cut out and discard a 15mm section of the outer sheath at the marked position;
- Push the inner cable through the sensor and refit the two sheath sections by clamping the ends in the slotted end tubes. Note that the inner cable should be a force fit into the sensor, otherwise the slotted disc inside the sensor will not rotate;
- Check that the inner cable is free to rotate, then re-install the speedometer cable in the vehicle.



Follow this parts overlay diagram if the speedometer cable distance sensor is used. If the magnetic pick-up sensor is used, the parts overlay diagram in the August issue should be followed, but note that the 4.7kΩ resistor must be deleted to accommodate the Moray fuel flow sensor.

As supplied, the speedometer cable sensor can be fitted to most speedometer cables. Readers should note, however, that it cannot be used in vehicles fitted with an electronic speedometer — eg XD and XE Ford Falcons — for the simple reason that such vehicles do not have a speedometer cable!

If you do elect to fit the speedometer cable sensor, then the PCB parts layout diagram accompanying this article should be followed. If the magnetic pick-up sensor is used, then the overlay diagram in the August issue should be followed but don't forget to delete the 4.7kΩ resistor in order to accommodate the Moray fuel flow sensor.

Once the sensors have been installed, the wiring to the Car Computer can be completed. Fig. 5 shows the recommended wiring to the 12-pin Utilux socket, as viewed from the front. The leads from the sensors are passed

through the firewall, and terminated to the appropriate mating pins on the matching plug. Make sure that you get these connections right, otherwise the circuitry could be damaged.

The +12V from the ignition switch and the permanent +12V supply can be obtained from the fusebox. Check the voltages available with a multimeter before actually connecting the leads, and make the connections to the fused side. The ground connection can be made at any suitable chassis point.

The Car Computer itself can be mounted at any convenient location on or under the dashboard, using a suitable U-shaped bracket. We'll leave it to readers to work out mounting details to suit individual model cars.

Operation

At first switch on, all memory locations have random numbers located in them. Press the START key to clear hour.min,

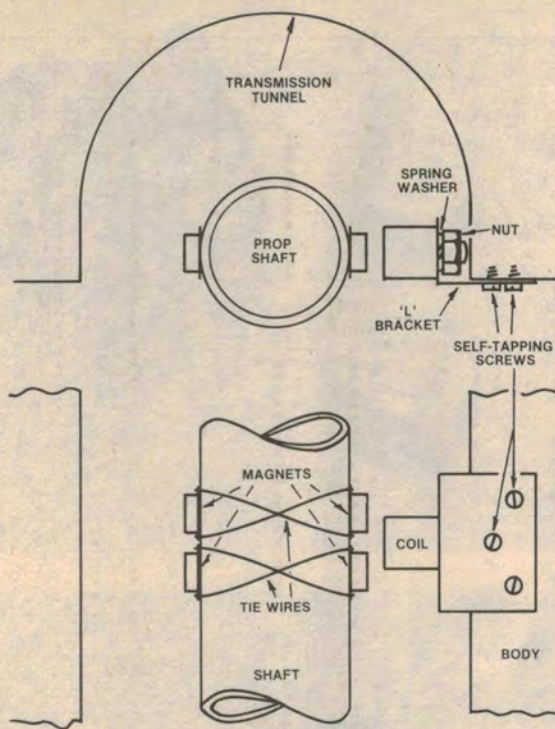


Fig. 3

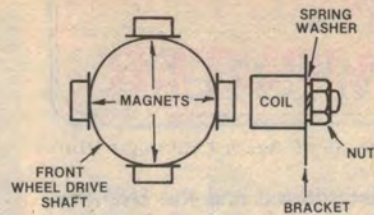


Fig. 4

Fig. 3 (left) shows how the magnetic pick-up sensor is installed in a rear-wheel drive car while Fig. 4 (above) shows the installation for a front-wheel drive car (see text).

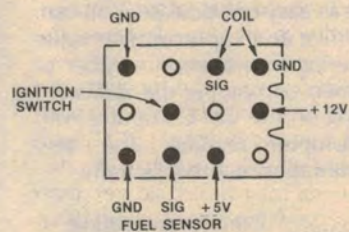


Fig. 5

Fig. 5: recommended wiring for the 12-pin Utilux socket, as viewed from the front. An additional connection to +5V will be required if the speedometer cable sensor is used.

litres, km, and their associated pulse count memories. Data to be entered initially includes the maximum fuel tank capacity, and the litres CAL and km CAL calibration numbers. The fuel remaining (litres REM) and journey length (km REM) figures must also be entered initially and, subsequently, each time fuel is added to the tank or a "new" journey undertaken.

Let's go through the procedure step-by-step:

- **Litres CAL.** The number to be entered here is the number of pulses that the fuel sensor provides for 0.1 litres of fuel flow. Each Moray sensor is precalibrated by the manufacturer, and a small tag on the sensor lead provides a clue to the calibration number to be used. On one side of the tag is a number for litres, and on the other a number for gallons. All you have to do is multiply the litre reading by 25.6 to get the litre CAL number for that particular sensor. For example, our Moray sensor has the number 67; multiplying this by 25.6 gives a calibration number of 1715 pulses per 0.1 litres.

To enter this number, first press the litres CAL key switch (key switch 6). The display should show a random number. Now press the ENTER key switch — the display will clear and the ENTER LED will light. Finally, enter the calculated calibration number and press the END key to extinguish the ENTER LED. For example, to enter 1715 press 6, ENTER, 1, 7, 1, 5, END.

The display will now show the calibra-

tion number just entered. If you are not convinced, press another function key and then return to the litres CAL key. The previously entered number will again be displayed. Note that although a decimal point can be entered into the calibration number, this will be totally ignored by the computer. After the END key is pressed, the decimal point will disappear.

It is a good idea to write the calibration number down and keep it in a safe place as it will have to be re-entered each time the battery is disconnected from the vehicle. The same applies to the distance calibration number (see below) and any other enterable data.

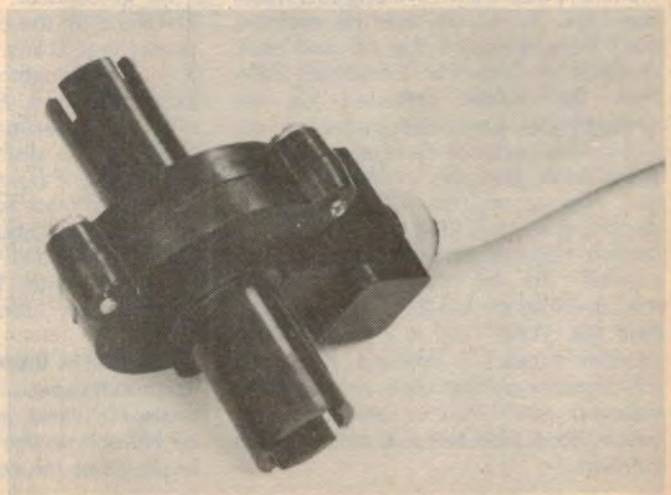
- **km CAL.** This is the number of pulses received from the distance sensor in one

kilometre. If you are using a magnetic pick-up sensor mounted on the tail shaft, an approximate distance calibration number can be calculated. Measure the wheel diameter (the horizontal distance) in mm, multiply by 3.14 (π) and divide the result into 1 million. This gives the number of wheel rotations per kilometre. Multiplying this value by the differential ratio of the particular car and then by two (two magnets on the shaft) will then provide an approximate number for the distance calibration.

The actual number will be in the region of 4000.

To enter the distance calibration number, first press the distance CAL key switch (key switch 7) followed by the ENTER button. The calibration number

The speedometer cable distance sensor can be used on both front and rear-wheel drive cars, but not on cars which have an electronic speedometer (eg, XD, XE Ford Falcon).



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can now be entered and the END key pressed to extinguish the ENTER LED (eg to enter 4000 press 7, ENTER, 4, 0, 0, 0, END).

The alternative speedometer cable sensor provides a similar number of pulses per kilometre, although the actual value is not as easy to calculate. You can, however, arrive at an approximate value by first entering a calibration number of 4000 and then comparing the indicated km/h reading on the Car Computer with the speedometer reading. The new distance calibration number is then:

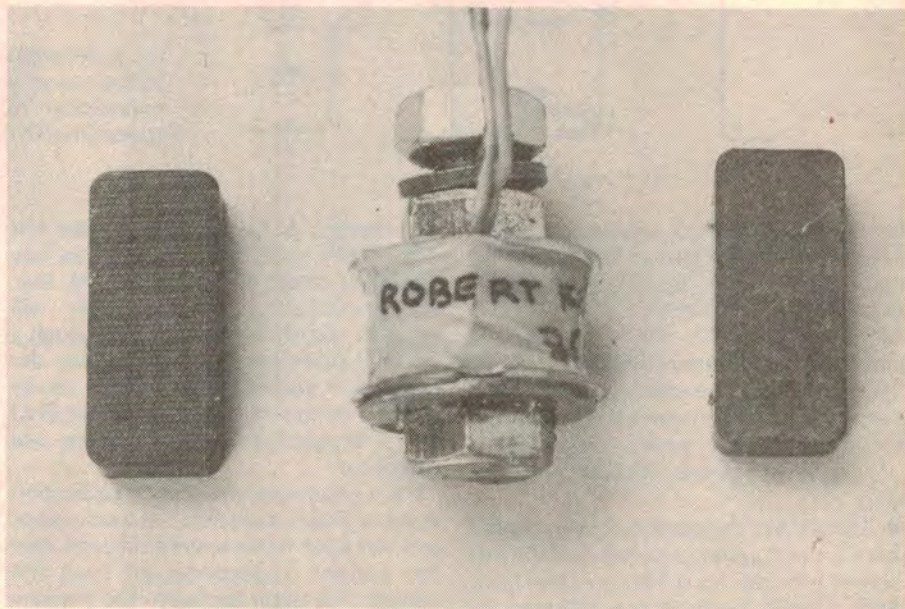
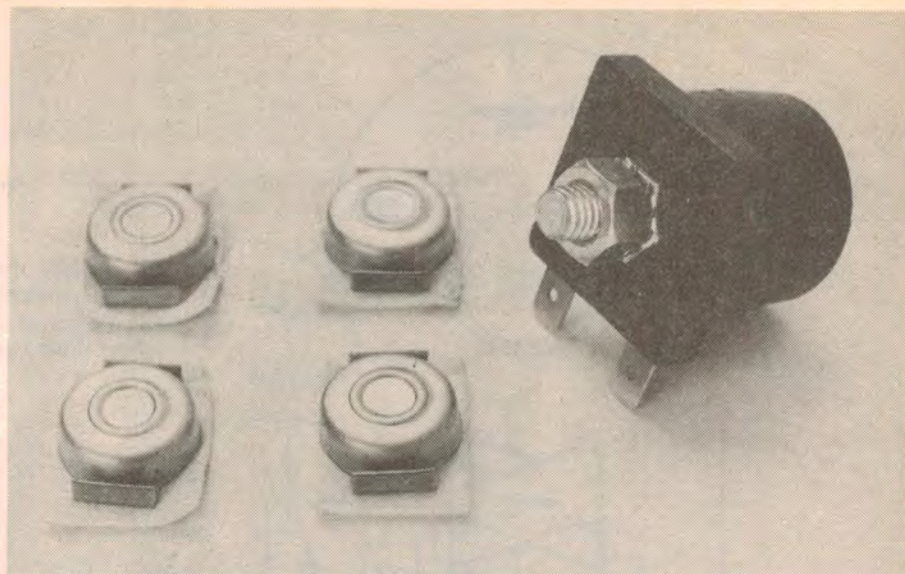
$$\text{km CAL} = 4000 \times \frac{\text{Computer reading}}{\text{Speedometer reading}}$$

Note that the maximum calibration number that can be fed in is 9999. If the calculated calibration number is greater than this, you will have to dismantle the sensor and remove half the number of vanes (either that, or use the magnetic pick-up).

The exact distance calibration number (both types of sensors) can now be found using one of two methods. First, a direct comparison can be made between the km reading on the Car Computer and the car's odometer. Zero the odometer trip meter, press the START button on the computer, and drive the car for 15-20km (longer journeys will give a more accurate result). The true calibration number is now calculated by multiplying the old calibration number by the computer reading and dividing by the odometer reading.

A more accurate method involves checking the indicated distance on the Car Computer against the kilometre marking posts located alongside major highways. If you do use this method, don't be surprised if the km and km/h readings on the Car Computer differ from the values indicated on the speedometer. Car speedometers are not particularly accurate devices!

● **km REM.** Press the km and REM keys and the associated LEDs will light, displaying the km REM value. Initially, a random number will be displayed. Once entered, the km REM value will be reloaded into the km REM memory each time the START key is pressed unless another distance is entered. This value will decrease by 1km for every kilometre travelled until zero is reached, after which the display will count down from 9999km.



Two versions of the magnetic pick-up sensor currently available from kit suppliers. See Figs. 3 & 4 and text for installation details.

To enter data, press km, REM and ENTER, enter the expected distance, and press the END key. For example, to enter a journey length of 483km press km, REM, ENTER, 4, 8, 3, END. Note that entering a decimal point will cause a "d.Err" to be displayed, indicating that the value will have to be entered again.

If the estimate for the distance of the journey is subsequently found to be incorrect, the km REM value can be changed at any time. The hour.min REM is automatically corrected for the new value.

● **litres REM RANGE.** This value is the maximum capacity of the fuel tank to the nearest 0.1 litres, as specified in the vehicle handbook. The value stored is actually provided for convenience when the

tank is filled, since it can be directly entered into the litres REM memory. Press litres, AV and ENTER, enter the tank capacity, and then press END. Note that the entry must be made to the nearest 0.1 litres, otherwise "F.Err" will appear on the display.

● **litres REM.** This is the actual amount of fuel in the tank, so new data must be entered each time fuel is added. Initially, a random number will appear and you will have to determine and enter the amount in the tank. The easiest method is to fill the tank and then enter the tank capacity. This is done by pressing litres and AV (to display the tank capacity), followed by ENTER and END. Do not enter any numbers. The litres REM RANGE value will now be stored in the

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litres REM memory, and this can be verified by pressing the litres and REM keys.

If the fuel tank is not completely filled, the extra fuel must be entered and added to the litres REM memory. To do this, press litres, REM and ENTER, enter the amount of fuel added to the tank, and press END. The entered value will be automatically added to the previously displayed litres REM reading. Once again, fuel must be entered to the nearest 0.1 litres otherwise "F.Err" will be displayed and the entered fuel will be ignored.

Error correction

Mistakes made in entering data, other than litres REM, are easily corrected by pressing END and ENTER, then re-entering the correct value. An incorrect litres REM entry is a little trickier, however, since the entered value is actually added to the previous value. Basically, you've got three choices:

If the decimal point has not been entered when the mistake is realised, press the END key to display "F.Err". This will prevent the entered value from being added to the previous value. All you have to do now is re-enter the correct value.

If the decimal point has been entered but the END key not pressed, the situation can be retrieved by typing in several leading zeroes followed by the correct number. Entering is cyclic, so any digits re-entered will overwrite the previously entered digits.

If, however, the decimal point and END keys have both been pressed, display litres REM RANGE, enter the previous litres REM value (assuming that you can remember what it was), and transfer this value to litres REM (see above). The fuel added is now re-entered in litres REM, and the correct fuel tank capacity re-entered in litres REM RANGE. If you are unable to remember what the previous litres REM value was, then you will have to fill the tank completely and transfer the litres REM RANGE value to litres REM.

Troubleshooting

If your Car Computer does not work, don't rush out and buy new ICs. Provided that they've been installed correctly and that the power supply is correct, the ICs are not likely to be at fault. Instead, go over the project carefully and check that you've inserted all pin-throughs (for

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0000 86 C9 B7 80 05 86 FF B7 80 04 B6 80 05 8A 04 B7
0010 80 05 F6 80 04 86 F1 B7 80 07 86 F8 B7 80 06 B6
0020 80 07 8A 04 B7 80 07 7F 00 20 96 1E 81 00 26 03
0030 7E 62 22 81 01 26 03 7E 63 A8 81 02 26 03 7E 62
0040 71 81 03 26 03 7E 63 62 81 04 26 03 7E 63 85 81
0050 07 26 03 7E 62 FB 81 06 26 D6 20 F7 7F 00 54 96
0060 54 81 00 26 2C 96 20 81 01 27 F4 96 1E 81 07 27
0070 EE 81 06 27 EA 81 05 27 E6 96 2C 81 3B 27 E0 96
0080 06 81 01 26 04 97 54 20 48 BD 65 ED 7C 00 5B 20
0090 CE CE 61 2A 96 54 5F A1 00 27 0B 08 5C 8C 61 36
00A0 27 02 20 F3 20 B6 C1 0B 27 20 96 20 81 01 27 28
00B0 C1 0A 27 10 C1 08 27 17 C1 09 27 13 D7 1E 7F 00
00C0 1F 7E 60 2A C6 01 D7 20 20 F7 7F 00 20 20 F2 D7
00D0 1F DE 26 08 DF 26 20 E9 A6 0C 20 2E 96 54 81 01
00E0 27 15 CE 09 00 09 26 FD 0E 96 23 B1 00 5A 27 07
00F0 86 FD B7 80 07 20 F1 DE 26 9C 28 27 06 09 DF 26
0100 7E 60 5C 08 08 08 DF 26 20 F6 81 00 27 06 DE 26
0110 A7 00 20 C8 DE 26 08 D6 29 5C 5C 5C D1 27 27 BC
0120 A6 00 8A 80 A7 00 DF 26 20 B2 22 42 0C 14 24 11
0130 09 21 41 44 0A 12 7E 44 3D 6D 47 6B 7B 4C 7F 6F
0140 00 97 21 DF 37 D6 37 C4 F0 8D 23 D7 2D D6 37 C4
0150 0F 8D 20 D7 2C D6 38 C4 F0 8D 13 96 21 81 20 26
0160 02 CA 80 D7 2B D6 38 C4 0F 8D 08 D7 2A 39 0C 56
0170 56 56 56 D7 60 CE 61 36 4F 91 60 27 08 4C 08 81
0180 0A 27 05 20 F4 E6 00 39 C6 7F 39 FF FF FF 96 2A
0190 84 7F 7F 00 21 8D 4E DE 37 E7 00 96 2B 85 80 26
01A0 25 8D 3B DE 37 EA 00 E7 00 96 2C 85 80 26 1F 8D
01B0 34 DE 37 09 E7 00 96 2D 85 80 26 1A 8D 20 DE 37
01C0 09 EA 00 E7 00 39 C6 20 D7 21 84 7F 20 D3 C6 40
01D0 D7 21 84 7F 20 D9 C6 80 D7 21 84 7F 20 DE 8D 05
01E0 58 58 58 58 39 5F CE 61 36 81 00 27 08 A1 00 27
01F0 04 08 5C 20 F8 39 CE 00 2F DF 26 CE 00 2A DF 28
0200 7E 60 DC 86 00 09 0C 66 00 08 66 00 4C 81 04 26
0210 F4 39 96 2E 8A 20 97 2E CE 00 00 DF 2A DF 2C 7E
0220 60 DC D6 1E C1 00 27 28 7F 00 2E DE 00 DF 12 CE
0230 00 00 DF 04 DF 08 DF 0E DF 06 DF 0A DF 10 86 1A
0240 97 2D 86 3B 97 2C 86 75 97 2B 86 67 97 2A 20 15
0250 D6 1F C1 08 27 15 C1 09 27 0B DE 04 86 01 97 2E
0260 86 00 BD 61 41 7F 00 20 7E 61 F6 86 81 DE 02 20
0270 ED D6 1F C1 00 27 31 C1 09 27 3A 96 20 81 01 27
0280 24 96 2E 81 A4 27 32 20 28 7F 00 20 D6 1F C1 08
0290 27 0B C1 09 27 0B 86 04 97 2E 7E 61 F6 86 84 20
02A0 F7 86 C4 20 F3 7E 62 12 DE 0E 86 00 BD 61 41 20
02B0 D8 DE 12 20 F5 DE 33 20 F1 86 13 97 38 7F 00 37
02C0 BD 61 8E CE 00 13 86 00 91 2C 27 0A 91 2B 27 09
02D0 91 2A 27 08 20 09 BD 62 03 BD 62 03 BD 62 03 96
02E0 21 81 00 27 10 86 F5 97 2D 86 3B 97 2C 86 11 97
02F0 2B 97 2A 20 94 DE 12 DF 00 20 B6 D6 20 C1 01 27
0300 0E 96 2E 85 20 26 1E 20 09 7F 00 2E 7E 61 F6 7E
0310 62 12 96 1E 81 06 27 09 DE 1A 86 00 BD 61 41 20
0320 E8 DE 1C 20 F5 7F 00 37 96 1E 81 06 27 0E 86 1B
0330 97 38 BD 61 8E CE 00 00 DF 10 20 0C 86 1D 97 38
0340 BD 61 8E CE 00 1D 20 03 CE 00 1B 86 00 91 2B 27
0350 06 91 2A 27 05 20 06 BD 62 03 BD 62 03 7F 00 2E
0360 20 B0 D6 1F C1 00 27 06 C1 09 27 13 20 0E 86 08
0370 DE 31 97 2E 86 00 BD 61 41 7F 00 20 7E 61 F6 86
0380 48 DE 14 20 ED 7F 00 20 D6 1F C1 00 27 06 C1 09
0390 27 10 20 0B C6 10 DE 35 86 20 D7 2E BD 61 41 7E
03A0 61 F6 C6 50 DE 52 20 F0 D6 1F C1 00 27 3F C1 08
03B0 27 0E 96 20 81 01 27 32 96 2E 31 E2 27 40 20 3A
03C0 96 20 81 01 27 24 96 2E 81 A2 27 74 20 28 7F 00
03D0 20 D6 1F C1 00 27 0B C1 08 27 0B 86 C2 97 2E 7E
03E0 61 F6 86 02 20 F7 86 82 20 F3 7E 62 12 DE 08 86
03F0 20 BD 61 41 20 D8 DE 0C 20 F5 DE 16 20 F1 7F 00

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boards without plated-through holes) that you've soldered both sides of the PCB as required, that all components are correctly oriented, and that none of the IC pins have been bent under the body of the IC.

Check also that the sensor connections are correct, and that there are no broken or shorted tracks on the PCB. If any of the digits fail to light, check driver transistors Q2 to Q5 and check for continuity between each digit driver output and pin 3 of the corresponding display. Similarly, if any segments fail to light, check for breaks in the segment drive lines between the PIA and the inverters (ICs 8 and 9), between the inverters and the displays, and between the displays themselves.

Detailed troubleshooting will generally require the use of a CRO, although the simple checks outlined above will usually be quite sufficient. For what it's worth, we built up three versions of the Car Computer without encountering any problems.

In use, calculated values such as hours.min REM, km REM RANGE, km/h AV and litres/100km AV will not give sensible readings until several kilometres have been travelled after pressing the START key. The litres/100km reading may also appear to be unusual when the vehicle is braked. As the vehicle slows the fuel consumption initially falls and then dramatically increases just before the vehicle is brought to a stop. This is because, at very low speeds, the distance travelled between fuel pulses progressively decreases while the fuel flow rate remains fairly constant.

The limiting case is obviously at standstill, when fuel is used but no distance is travelled. The litre/100km value then becomes infinite, however the Computer will not display this since no distance pulses are received.



"Hold it! I ordered two MICRO farad!"
(Radio Electronics).

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0400	18	7F	00	19	DE	2C	8C	00	00	27	2F	86	51	97	38	7F
0410	00	37	BD	61	8E	96	21	81	80	27	0A	81	40	27	0C	81
0420	00	27	4A	20	0C	CE	00	51	BD	62	03	CE	00	51	BD	62
0430	03	7F	00	21	DE	50	DF	16	20	C0	DE	16	DF	0C	20	B6
0440	86	51	97	38	7F	00	37	BD	61	8E	96	21	81	80	27	0C
0450	81	40	27	0E	81	00	27	15	20	0E	20	98	CE	00	51	BD
0460	62	03	CE	00	51	BD	62	03	7F	00	21	20	10	86	9B	97
0470	2D	86	3B	97	2C	86	11	97	2B	97	2A	20	DD	96	51	9B
0480	0D	19	97	0D	96	50	99	0C	19	97	0C	20	B1	86	00	97
0490	48	97	47	97	46	97	45	97	42	97	41	97	3E	86	04	C6
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04D0	00	5A	26	FA	4A	39	86	04	C6	03	CE	00	3E	66	00	08
04E0	5A	26	FA	4A	26	F2	C6	02	D7	49	CE	00	47	09	A6	00
04F0	E6	02	A7	02	E7	00	7A	00	49	26	F2	DE	47	DF	43	39
0500	C6	03	CE	00	3E	86	99	A0	00	A7	00	08	5A	26	F6	0D
0510	C6	03	09	86	00	A9	00	19	A7	00	5A	26	F5	39	C6	03
0520	CE	00	41	0C	09	A6	00	A9	03	19	A7	03	5A	26	F5	39
0530	DE	05	DF	43	7F	00	44	CE	00	60	DF	3F	BD	64	8D	DE
0540	04	DF	3F	96	44	97	40	DE	0E	DF	43	BD	64	8D	DE	44
0550	DF	14	39	DE	12	DF	43	DE	14	DF	3F	BD	64	8D	96	44
0560	97	02	DE	45	DF	43	CE	01	67	DF	3F	BD	64	8D	96	44
0570	97	03	39	DE	08	DF	43	DE	0E	DF	3F	BD	64	8D	DE	44
0580	DF	52	39	DE	0C	DF	43	DE	52	DF	3F	BD	64	8D	DE	44
0590	DF	33	39	DE	1A	DF	43	CE	36	00	DF	3F	BD	64	8D	DE
05A0	44	DF	57	DE	57	DF	3F	DE	55	DF	43	BD	64	8D	DE	44
05B0	DF	31	39	DE	1C	DF	43	DE	1A	DF	3F	BD	64	8D	DE	45
05C0	DF	57	DE	5E	DF	43	DE	5C	DF	3F	BD	64	8D	96	1C	85
05D0	10	27	13	DE	44	8D	06	DE	45	20	0F	DE	45	DF	43	DE
05E0	57	DF	3F	7E	64	8D	8D	F3	DE	44	DF	35	39	96	06	81
05F0	09	27	1A	81	02	27	19	96	5B	81	01	27	16	81	02	27
0600	15	81	03	27	14	81	04	23	13	7F	00	5B	39	7E	65	B3
0610	7E	65	93	7E	65	30	7E	65	53	7E	65	73	7E	65	83	B6
0620	80	07	F6	80	06	85	80	27	04	BD	66	D8	3B	86	01	97
0630	59	B6	80	05	F6	80	04	8A	3F	81	BF	27	09	81	7F	27
0640	0A	81	FF	27	0B	3B	BD	66	59	20	0A	BD	66	A3	20	05
0650	BD	66	5F	20	F6	7F	00	59	3B	CE	00	30	8D	35	CE	00
0660	11	8D	30	CE	00	3A	8D	2B	DE	10	9C	1A	27	01	39	7F
0670	00	10	7F	00	11	CE	00	0F	8D	19	CE	00	13	8D	01	39
0680	8D	06	25	03	09	8D	01	39	86	99	80	01	0D	A9	00	19
0690	A7	00	39	A6	00	8B	01	19	A7	00	09	A6	00	89	00	19
06A0	A7	00	39	CE	00	0B	8D	EB	CE	00	19	8D	E6	CE	00	3C
06B0	8D	E1	DE	0A	9C	1C	27	07	DE	18	9C	1C	27	0E	39	7F
06C0	00	0A	7F	00	0B	CE	00	09	8D	C9	20	EC	CE	00	0D	7F
06D0	00	18	7F	00	19	8D	A9	39	96	06	4C	81	0F	27	07	97
06E0	06	81	08	27	04	39	7F	00	06	D6	1E	C1	00	27	34	81
06F0	08	27	F2	96	07	4C	97	07	DE	39	DF	55	7F	00	39	7F
0700	00	3A	81	3C	27	2F	D6	1C	C5	10	26	07	84	07	81	07
0710	27	01	39	DE	3B	DF	5E	DE	2F	DF	5C	CE	00	00	DF	3B
0720	DF	2F	39	D6	2C	81	08	27	06	C4	7F	D7	2C	20	C0	CA
0730	80	D7	2C	20	BA	7F	00	07	CE	00	05	A6	00	8D	01	39
0740	81	59	27	06	8B	01	19	A7	00	39	6F	00	09	A6	00	20
0750	F3	CE	00	2D	A6	00	81	7E	27	0E	81	FE	27	0A	81	80
0760	27	06	81	00	27	02	20	0C	84	80	A7	00	09	8C	00	2A
0770	27	F4	20	E0	86	00	B7	80	04	96	22	DE	24	B7	80	06
0780	D6	59	C1	00	26	0B	D6	54	C1	00	26	05	B1	80	06	26
0790	28	E6	00	F7	80	04	08	8C	00	2F	27	07	48	DF	24	97
07A0	22	20	09	CE	00	2A	86	08	DF	24	97	22	96	59	81	00
07B0	20	01	3B	B6	80	06	97	5A	3B	B6	80	06	97	54	96	22
07C0	97	23	3B	8E	00	7F	7F	00	2E	7F	00	54	86	08	97	22
07D0	97	23	CE	00	2A	DF	24	7F	00	59	CE	00	00	DF	5C	DF
07E0	5E	DF	2F	DF	55	DF	3B	DF	39	DF	31	DF	35	DF	52	DF
07F0	5A	7E	60	00	FF	FF	FF	FF	66	1F	FF	FF	67	51	67	C3