Electronic Odometer

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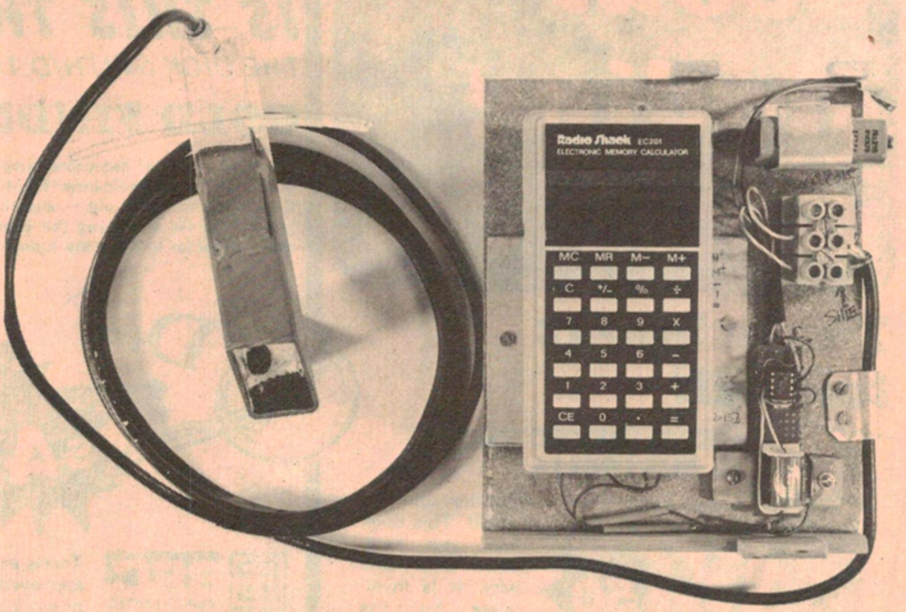
THIS DEVICE, which is inexpensive and easy to build, will measure accurately how far a vehicle has travelled over the ground. It is of particular interest to persons who want to know accurately how far they have travelled down any of the thousands of unmarked bush tracks in Australia.

The device works by counting the revolutions of the back wheel of the vehicle using a phototransistor which looks at a white strip painted on the tyre. Signals from the phototransistor are processed in an integrated circuit to provide pulses at high enough level to operate a relay. Counting is achieved by making the relay operate in parallel with a function key on a cheap electronic pocket calculator.



Overall view of my odometer. The calculator and electronics are attached to a chipboard base. The phototransistor sensor is mounted on the wheel guard and connects via shielded cable.

The Circuit

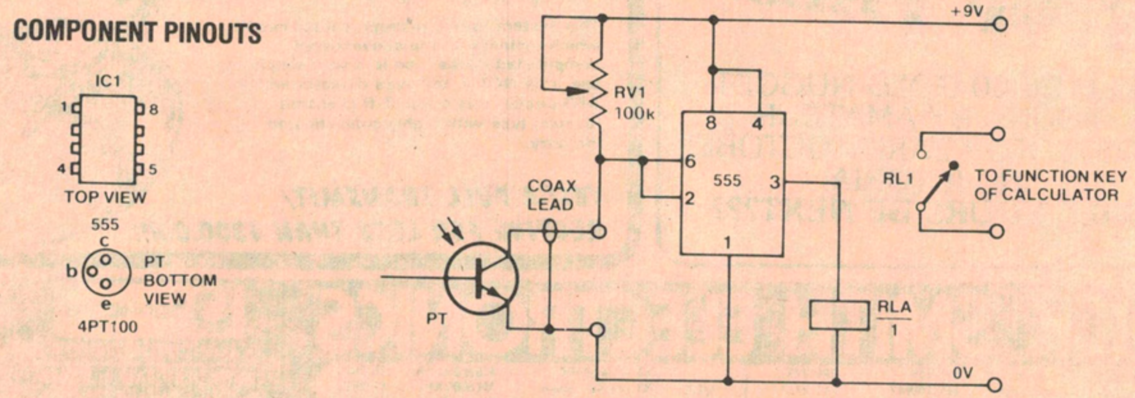
A 555 is connected to operate in the monostable mode as shown in the circuit. Its operation is controlled by a phototransistor type 4PT100 which has excellent sensitivity. The base connection of the phototransistor is not used.

Under "dark" conditions the collector-emitter resistance of the phototransistor is high and this holds the 555 in the 'off' state (pin 3 low). When the phototransistor is illuminated its resistance falls and the voltage at pin 2 falls. When this reaches about two thirds of the supply voltage, pin 3 is switched to the high state. Potentiometer RV1 provides control of the triggering point of the 555, permitting adjustment of the level of lighting which is to trigger the device.

The output from pin 3 operates a small reed relay. This can be any small relay with a coil resistance greater than 60 ohms. The type used was a Marble MEL 400, available from Dick Smith.

A Tandy pocket calculator type EC-201 was chosen to do the counting because successive unit additions or subtractions can be achieved by the operation (after setting up) of one function key, in this case the (=) key. Not all cheap calculators have this "totalling" facility. The contacts of the reed relay are parallelled across this function key.

Care has to be exercised when opening the calculator to ensure that the four moulded locking tags are not broken off. When opened, peel the sheet of switch retaining plastic back from the area of the = switch and solder two 100 mm long tails to the printed circuit runs leading to each side of this



The circuitry is simplicity itself. The potentiometer (RV1) provides control of the triggering point of the 555. The function key you use on the calculator will depend on the make — the Tandy EC-201 (like most) will totalise using the = key, others employ the + key.

switch. Spend some time preparing the surface and ensure that a good soldered joint is made.

The switch board inside the calculator sits on four plastic spigots and a way has to be found to get the board back onto these spigots while closing the case, otherwise there might be problems with the relative positioning of the keys on the case and the switches on the printed circuit board. When you have closed the calculator I suggest that you secure the wires to the case with epoxy glue to take the strain off the soldered connections.

The sensor assembly is shown in the photograph. It is made of 23 mm square-section lightweight steel tube with a flange welded to it to match the turned-in flange of the mudguard. It is secured to the mudguard by two self-tapping screws.

One end of the tube is sawn off at an angle to give an end parallel to the tyre. The other end is drilled and a small steel tube welded over the hole to form a gland. The purpose of the gland is to take the strain of the cable off the electrical connections of the device inserted into the tube and to make it watertight. When mounted, the sensor is no more than 20 mm from the tyre.

The phototransistor, which incidentally can be obtained from Tandy, and terminals were fixed to a strip of paxolin and slipped into the sensor tube and sealed in place with silicone rubber. To eliminate the effect of glare, a small plastic tube, painted with matt black, was slipped over the phototransistor and held in place with silicone rubber. The coax lead was fed through the gland and soldered to the terminals. The gland was then sealed with epoxy glue and the sensor tube was sealed with silicone rubber.

A point which must be taken into consideration is movement of the wheel vertically with respect to the mudguard (when the vehicle is laden or when it lunges). The ideal mounting point for the sensor is at 3 o'clock. Thought should also be given to covering the end of the sensor tube with clear plastic to keep it free from dust and water.

The few components used in association with the calculator were mounted together with the calculator on a wooden board as shown in the photograph. In the arrangement shown, the calculator and relay circuit each have their own nine volt batteries.

Setting up

Test the circuit in stages during construction. Set RV1 to mid position to start with and adjust it subsequently to take account of the light level. The unit is so simple that there is really nothing else to do. This unit has been used at speeds up to 50 kph but it might do a lot more and be of some interest to rally drivers. Cyclists might even be interested. I built my system to help me find my way to remote gold mining sites located in the depths of State forests.

The advantage of using a calculator to do the counting is that, apart from being ready-made, it will allow a constant to be keyed in so that it will display the exact distance travelled in yards, metres, miles etc., instead of just wheel revolutions. ●