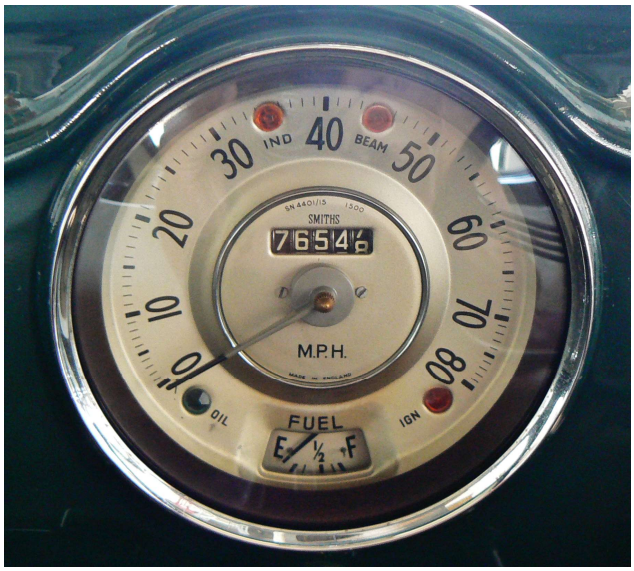
"We All Run On Two Clocks"

A theory propounded by Max Lerner, in the introduction to his hypothesis concerning the human 'body clock'. Ever since their introduction car speedometers and other gauges have been, with a few exceptions, erroneously nicknamed 'clocks'. Here, we will look at a few auxiliary gauges or 'clocks', and their fitting.



Before taking Mr. Lerner's ideas on metabolism too seriously we must remember that he was not a physician but a journalist. In keeping with his notion however, the standard (post series MM) Morris Minor was a "two clock" layout comprising a speedometer and a petrol gauge; rather basic perhaps but cost - cutting was just as important then as now.

A little further up the price range, most family saloons had a little more instrumentation on their dashboards; always a fuel gauge plus any combination of oil pressure gauge, temperature gauge, ammeter and timepiece. Such gauges, if working properly, are of much

practical value and a certain source of comfort, particularly on vehicles which are used for long journeys and here it is proposed to discuss the fitting of these. Perhaps the most useful is a temperature gauge followed by voltmeter/ammeter and oil pressure gauge. A timepiece is well - worth preserving if an original fitting, otherwise can be considered superfluous in these days of electronic watches, mobile phones etc. The manifold vacuum gauge can reveal much about an engine and its driver but is an acquired taste which does not appeal to all.

The best- known and commonest make of gauge is Smiths, and it is the only make for anyone hoping to compile a matching set. The Smiths Instrument Company has moved into higher technology but Caerbont Automotive Instruments Ltd. in South Wales makes identical products which, with the blessing of Smith's, carry that firm's name (fig. 1).

Fig.1

Second-hand gauges of various makes are available, Ebay usually having quite a few on offer at all times. It is of course vital to ensure that used items are in working condition, some types being easier to test than others. Voltage indicators are often inaccurate and temperature gauges with electrical sensors are the least likely to give a correct reading unless some careful component matching is achieved.

Unfortunately, the Minor's dashboard arrangement does not leave a great amount of scope for the fitting of extra gauges without doing permanent damage. Favourite locations, which will not disfigure

Fig.2

your car irreversibly are below the dash on separate brackets or on a panel, usually of wood, (fig. 2) fitted into the driver's glovebox aperture, thus gaining extra mounting space but preventing its normal use.

With a wooden panel you are on your own when it comes to manufacture. There are fibreglass replacement glove box doors with three 2" holes for gauges which are available via the internet. Metal underdash brackets are easily available and can accommodate one, two or three gauges. They are not too difficut to make at home, but remember to cut the large hole(s) first!

All auxiliary gauges will require either extra wiring or tubing which passes through the bulkhead. Care must be taken here to avoid chafing; the main wiring harness grommet can usually accommodate these. For ease of assembly at the factory the grommet and its clamping plates are split, removal of the three self-tapping screws will release the assembly and give access.

Fig.3

The voltmeter, (figs. 1 & 3) also known as a 'battery condition indicator' is a simple instrument which measures the voltage, or 'potential difference' across the battery.

With the vehicle 'at rest' it is the voltage of the

battery alone which is indicated; a decent one will show 12-13 volts. With the engine running there should be a slight rise in the reading, 13-15 volts on an alternator-equipped vehicle, owing to the charging system coming into play.

Traditionally, an *ammeter* would have been used in conjunction with a dynamo charging system but there is nothing wrong with using a voltmeter, although its 'on charge' reading will be slightly lower than with an alternator, typically 13-14 volts. The two-wire output found on most aftermarket alternators creates a problem fitting an ammeter; a voltmeter is a much easier alternative.

Unlike an ammeter, a voltmeter does not indicate the amount of current going in or out of the battery. Instead it samples the voltage of the system and offers the suggestion that if the reading is within satisfactory limits, all is well.

Both types of meter have good and bad points, neither can give total assurance that your electrical system is perfect, but they will alert the user to fundamental problems.

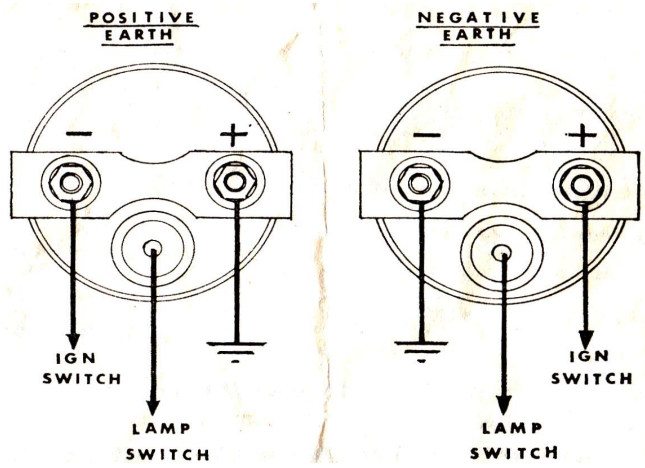


Fig.4

Wiring up a voltmeter is extremely simple, as there are only two wires see fig. 4, and they don't need to be of heavy gauge because a voltmeter merely takes a sample, unlike ammeters which have the entire current passing through them. It doesn't matter which way round a Smiths meter is connected, but some makes of meter are fussy about polarity, these will have their

terminals marked + and - in the usual fashion. If your car is negative earth, connect the negative terminal of the meter to a good earth point. For positive earth cars, the positive terminal should be earthed. The remaining terminal must be connected to any convenient 'live' source which is controlled by the ignition switch. The fuse box is as good a place as any; on a Minor, connect to the same terminal as the white coloured wires. Connecting the meter to a *permanently* live source is not recommended as it will be in circuit all the time regardless of the ignition switch and will slowly drain the battery when the car is not being driven.

There should also be a provision for internal illumination of the gauge and the wire from the bulb holder must be connected to the panel lamp circuit behind the dash. The casing of the meter may need to be earthed. It is always important to make good electrical connections, soldering terminals on, insulating where necessary and keeping wiring neat and tidy.

Fig.5

The lubrication system of an engine can be reasonably compared with the circulation of blood in the human body, being a continuous flow, which must stay within prescribed limits. Too much pressure can lead to problems, whilst too little is almost certainly fatal. An ideal pressure reading does not necessarily mean there is good circulation.

When starting an engine from cold, the oil is viscous and flows less freely creating extra pressure which is relieved by a spring-loaded valve. As the engine warms up the oil thins and the pressure drops accordingly, the relief valve closes and the engine must survive on whatever its oil circulation system is capable of. A badly worn oil pump or crankshaft bearings will cause low pressure, as will a faulty relief valve.

Using an engine with low oil pressure will shorten its life dramatically, thus the oil pressure gauge was born, but it's a rarely - seen fitment on modern cars as nowadays oil is much improved and generally speaking the lubrication system of an engine is pretty foolproof. It is a source of comfort however, when taking an older car on a long journey, to know that all is well in the lubrication department, and with this in mind many owners fit an oil pressure gauge.

Fig.6

These gauges are calibrated in 'bar', 'pounds per square inch' or both. For our pre-decimal Minors a P.S.I. scale is most suitable, as in fig. 6 which shows a combined oil pressure and temperature gauge, an excellent space-saving idea. Most gauges have provision for internal illumination, which is essential if you want to be able to read the gauge in the dark.

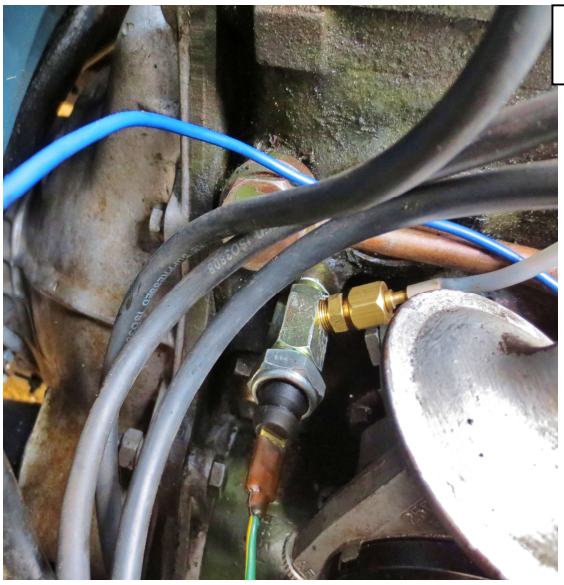


Fig.7

Fig.8

If the car's oil pressure warning lamp is to be retained, a T-piece such as in figs. 7 & 8 will be needed to accommodate its sensor plus the oil gauge pipe. An alternative way of tapping into the main oilway without disturbing the sensor is seen in figs. 9 & 10. where the main oilway's banjo bolt is drilled and tapped to accept the pipe to the gauge.

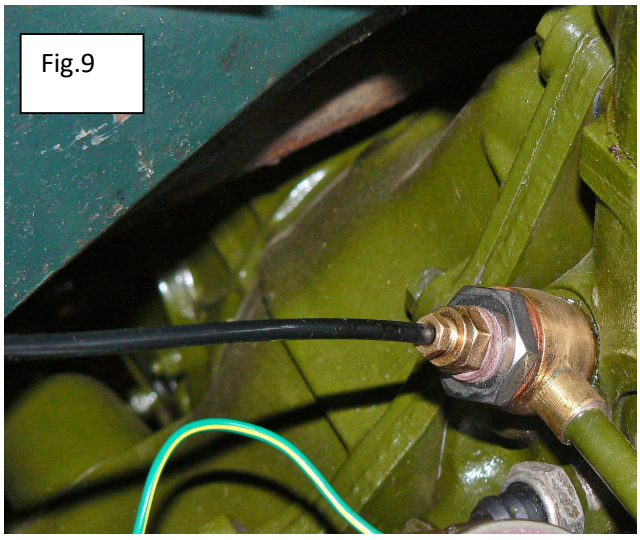


Fig.9

Seen in fig. 11 are the instructions supplied by Smiths in the 1960s; nothing much has changed except we are now more likely to be using plastic tubing rather than copper. If a secondhand gauge has been acquired it may not have any fittings, this is not much of a problem as 1/8"BSP fittings can be obtained at specialist retailers or online. Here can be found companies

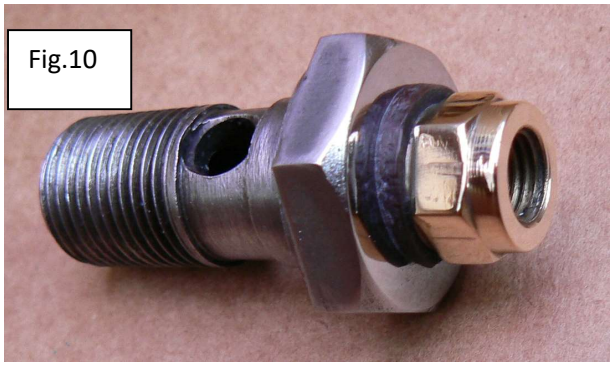


Fig.10

Oil pressure gauge

Codes PB, PSB

These kits contain an oil gauge, 6' pipe line, connector and tee piece. Most cars not fitted with an oil pressure gauge have an oil pressure warning light. To fit the oil pressure gauge, remove the oil pressure warning light switch which is normally located on the side of the engine, and screw the connector into place.

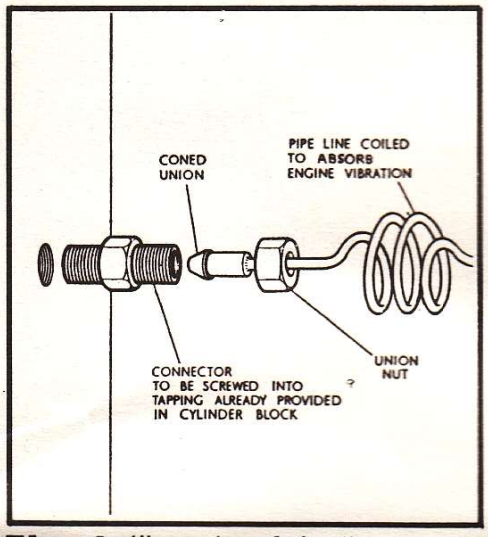


Fig. 1 *Illustration of pipe line fitted.*

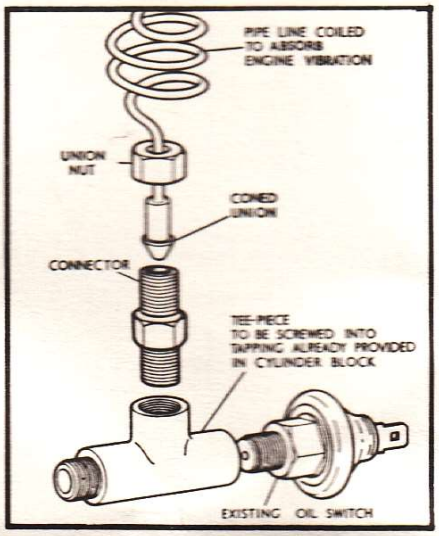


Fig. 2 *Illustration of pipe line and tee piece fitted.*

Then fit the pipe line to the connector, ensuring that the end of the pipe line which terminates with a coned union is used (Fig. 1).

Take the pipe line by the most convenient route to the gauge through a $\frac{5}{8}$" diameter hole drilled in the bulkhead. Coils of not less than 2" diameter should be made near each end of the tubing to take up engine vibration. The other end of the pipe line, which terminates with a flat union, should then be connected to the gauge, ensuring that the small leather washer is in position. If it is required to retain the use of the oil pressure warning light, the tee piece provided should be used to enable both the warning light switch and pipe line to be fitted (Fig. 2).

(In the case of B.M.C. 'A' series engines, it is advisable to remove the main oil feed pipe in order to screw the tee piece home. The pipe line should be refitted to the branch of the tee piece so that it points forward along the cylinder block, before curving back towards the bulkhead.)

Note: Special 'T' pieces are available for Rover cars and all Vauxhall models after 1963.

Fig.11

who are willing to sell tubing in as small a quantity as one metre, which is all that should normally be needed on a Minor. The diameter of the tubing will probably be governed by the type of fitting at the engine end. When using olives on plastic tubing, to form a

compression joint, tubing 5mm o/d and above requires a metal insert inside the tube to give strength. According to the suppliers, 4mm should not need it, but at the (hot) engine end it may be as well to use one anyway, just to be on the safe side. All connections must be sound, if one comes adrift whilst the engine is running, its lifeblood will haemorrhage at a potentially fatal rate!

The relief valve on the BMC 'A' series engine is arranged to lift at 50-60 p.s.i. and when starting from cold this reading should be seen, even at tickover. With a thoroughly warmed engine, 40-50p.s.i. is normal when driving, but may well drop to 20 p.s.i. at tickover.

The day may come when your engine can't stand the heat any more and boils over in a spectacular fashion. Unlike modern cars, the standard-issue Minor has no coloured lights or stentorian alarm to warn of this event which is guaranteed to occur at the most inconvenient part of the journey. Running an engine too cool is no good thing either, as its efficiency will be impaired, internal condensation will form and the heater, such as it is, won't warm up.

Like the human body, your engine has a small temperature range within which it will perform best, and the only way to monitor the proceedings properly is by installing a temperature gauge. The cylinder head is the hottest part of the cooling system and usually the water temperature is measured here or on the thermostat housing. There are two methods of operation for gauges, those which rely on an electrical connection between sensor and gauge, (fig. 12/13) needing careful component matching, and those which are connected by a capillary tube and which cannot be dismantled or tinkered with (fig. 14).

Fig.12

Fig.13

On the 1098 cylinder head there is a 5/8" UNF threaded hole in the head casting, beneath the thermostat housing which will accept either type of sensor. 950 heads don't have this, but an alternative thermostat housing is available with an added boss, as in

Fig.14

fig. 15. These housings have a slightly higher outlet than standard but do not normally present any problem, owing to the flexibility of the radiator connection.

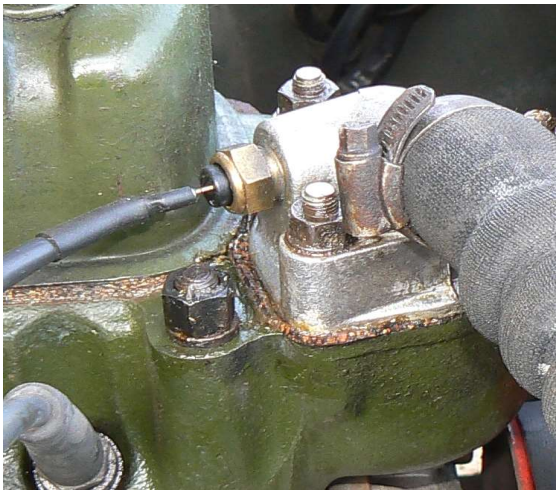


Fig.15

When fitting the capillary-tube type of gauge to a Minor, the sensor bulb and its nut will pass through the main harness grommet in the bulkhead if the triangular retaining plates are removed. Care must be taken to avoid kinking of the thin tube as once damaged it renders the assembly unserviceable.

It is not a bad idea to treat your engine to a new thermostat before expecting a sensible gauge reading; they don't last forever and can, if faulty, lead to intermittent and frustrating problems.

Always a radical thinker, Aristotle maintained that a vacuum could not happen in nature because a void would naturally fill with the surrounding substance, if only air. On a slightly higher plane he argued that a vacuum is composed of nothing, cannot be described and therefore cannot exist.

He was to be proved wrong on the second premise, but his idea of a vacuum being filled by nature is sound, and may be applied to the conditions inside the inlet manifold of a normally-aspirated internal combustion engine. When running, the pistons suck in air which is replenished from the atmosphere, thus in the manifold we have a 'partial' vacuum, which varies according to the throttle position and the load on the engine.

This vacuum is what may be considered as 'negative pressure' and when measured, its value can be a useful diagnostic tool as well as an indication of how the engine and its driver are performing. The traditional British unit of vacuum is 'inches of mercury' (in/Hg) some gauges are calibrated in fractions of 1 Bar which is the Continental fashion. One Bar being standard atmospheric pressure or 29.5 in/Hg.

A variety of dial faces may be encountered, some being simply calibrated as in fig. 17 & 18. The 1960's Smiths gauge to their left (fig.16) has coloured sectors added for ease of reading when on the road and is probably the most sought-after. In the 1950's the RedEx gauge had printed diagnostic advice on the infield of the dial (fig. 18).

Some makes of gauge have a 1/8" BSP connection as shown above and on the left in fig. 19; others have a simple nipple over which the tubing fits, as seen on the right in fig. 19.

The manifold tapping should be central and just behind the carburettor (fig. 20). If the tapping is right or left of centre, a biased

reading will be obtained. Screen washer tubing is not suitable to connect these gauges as it is unable to handle the heat at the manifold end. The best option is 4mm PVC tubing with a compression joint at the manifold end and compression fitting or rubber 'adaptor' at the gauge (fig. 20).

A restrictor is placed inside the tubing, near to the manifold tapping. This goes some way towards the damping out of pressure fluctuations particularly when the engine is idling; the gauge will work without it but will suffer from needle flutter particularly at tickover.

It is recommended to obtain a gauge with internal illumination, the wiring for this to be connected to the panel lamp circuit. The body of the gauge may need to be earthed.

Fig.16

Fig.17

Fig.18

Fig.19

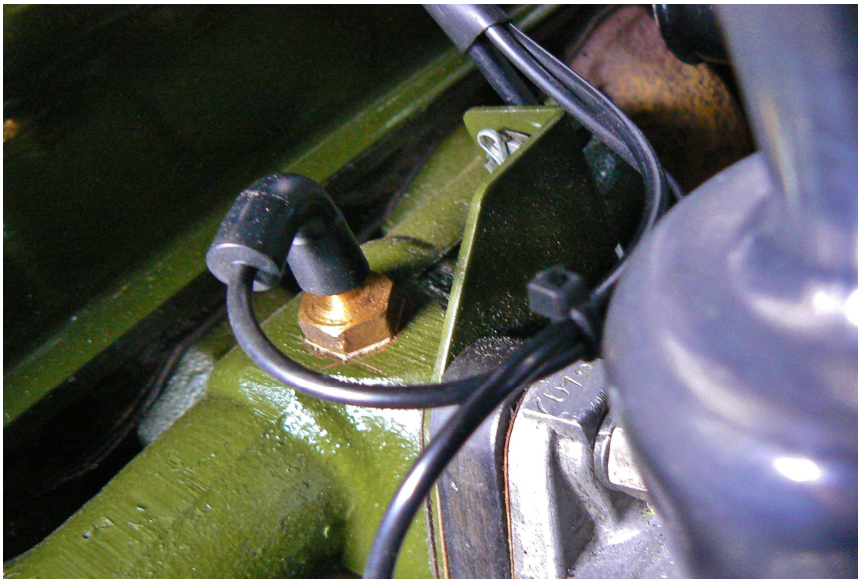


Fig.20