

Chapter 9 Electrical system

For modifications, and information applicable to later models, see Supplement at end of manual

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Degrees of difficulty

Easy , suitable for novice with little experience 	Fairly easy , suitable for beginner with some experience 	Fairly difficult , suitable for competent DIY mechanic 	Difficult , suitable for experienced DIY mechanic 	Very difficult , suitable for expert DIY or professional 
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Specifications

System type	12 negative earth, battery alternator and pre-engaged starter
Battery	
Except 70S	30 Ah
70S	40 Ah
Alternator	
Type	Marelli, Valeo or Bosch 45A, 55A or 65A, with integral voltage regulator
Nominal voltage	14 V
Minimum brush (wear) length	6.0 mm (0.236 in)
Starter motor	
Type	Marelli, Bosch or Femsa pre-engaged
Nominal power	0.8 kW or 1.0 kW
Armature shaft endfloat	0.1 to 0.5 mm (0.0039 to 0.0197 in)
Minimum brush (wear) length	10.0 mm (0.39 in)
Wiper blades	
Front	Champion X-4801 (19 in) or X-4503 (18 in)
Rear	Champion X-3303

Fuses

Circuit protected	Fuse rating (A)
1 Stop lamps, direction indicator lamps, instrument panel warning lamps, tachometer economy gauge, check control system	10
2 Windscreen wiper and washer, rear screen wiper/washer, check system panel illumination	20
3 Left front parking, right rear tail lamp, cigar lighter illumination, heater control and clock, digital clock illumination	7.5
4 Right front parking lamp and left rear tail lamp, instrument panel illumination and rear number plate lamp	7.5
5 Left-hand dipped headlamp, rear foglamps	10
6 Right-hand dipped headlamp	10
7 Left-hand headlamp (main beam)	10
8 Right-hand headlamp (main beam)	10
9 Engine cooling fan and horn (Comfort)	25
10 Heater booster fan, digital clock map reading lamp	20
11 Heated tailgate glass	20
12 Courtesy lamps, cigar lighter, radio power feed, disc pad sensors, economy gauge (ES models)	10
13 Hazard warning lamps	10
14 Spare (Comfort), Horn (Super)	20

Bulbs

	Wattage
Headlamp	40/45 or Halogen H4 60/55
Front parking	5
Side repeater	5
Tail	5
Stop	21
Reversing	21
Rear foglamp	21
Direction indicator	21
Rear number plate	5
Courtesy lamp (roof)	10
Courtesy lamp (pillar)	5
Warning and indicator	Wedge base

Torque wrench settings

	Nm	lbf ft
Alternator mounting and adjustment nuts	50	87
Starter motor bolts	48	35

1 General description

The electrical system is of 12 volt negative earth type and employs a belt-driven alternator and a pre-engaged type starter motor.

The models in the range are all adequately equipped with electrical accessories, while SX versions also have power windows and centralised door locking plus a check control system (Section 34).

2 Battery - inspection, charging, removal and refitting



1 The battery is of maintenance-free type and under normal circumstances, no topping up will be required, but regularly check that the electrolyte level is between the minimum and maximum lines on the translucent battery casing.

2 If the electrolyte level does drop below the

minimum line, suspect a leak in the battery casing or that the alternator is overcharging. If the latter is the case, rectify the alternator fault and then prise out the two rectangular plugs from the top of the battery and top up with distilled or purified water.

3 Always keep the battery terminals clean and smear them with petroleum jelly to prevent corrosion.

HAYNES
HiNT *If battery terminal corrosion has occurred, it may be neutralised by applying sodium bicarbonate or household ammonia.*

4 The battery will normally be kept fully charged by the alternator, but it is possible for the battery to become discharged if the daily mileage is very low with much use being made of the starter and electrical accessories.

5 When the battery begins to deteriorate with age it may also require a boost from a mains charger.

6 Disconnect both battery leads before connecting the mains charger.

7 To remove the battery from the car, first disconnect the leads from the battery terminals (earth first) and then unscrew the securing clamp from the casing projection at the base of the casing (photo).

8 Lift the battery from its mounting platform. Refitting is a reversal of removal. Reconnect the earth cable last.



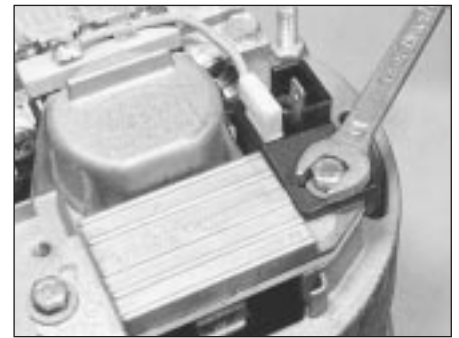
2.7 Battery clamp



4.2A Alternator mounting



4.2B Alternator adjuster bolt



5.3A Alternator brush holder bolt

3 Alternator - maintenance and precautions



To avoid damage to the alternator, the following precautions should be observed.

- 1 Disconnect the leads from the battery before connecting a mains charger to the battery terminals.
- 2 Never stop the engine by pulling off one of the battery leads.
- 3 Disconnect the battery if electric welding is to be carried out on the vehicle.
- 4 If using booster cables from another battery to start the car, make sure that they are connected positive to positive and negative to negative.
- 5 Maintenance consists of keeping the outside of the alternator clean, the electrical connections secure and the drivebelt correctly tensioned, see Chapter 2, Section 8.

4 Alternator - removal and refitting



Note: Depending on the model, access to the alternator from above may be poor in which case it will be necessary to work from the underside of the vehicle, through the right-hand wheel arch (after removing the roadwheel and the lower undershield). Refer to Chapter 13 for details.

- 1 Disconnect the leads from the rear of the alternator.



5.3B Removing alternator brush holder

- 2 Release the mounting and adjuster link nuts and push the alternator as far as it will go in towards the engine (photos).
- 3 Slip the drivebelt from the pulley.
- 4 Remove the mounting and adjuster bolts and lift the alternator from the brackets on the engine. Remove downwards on 1116 cc and 1301 cc models.
- 5 Refitting is a reversal of removal, tension the drivebelt as described in Chapter 2, Section 8.

5 Alternator - overhaul



- 1 Overhaul of the alternator should be limited to renewal of the brushes. If the unit has covered a high mileage, it will be found more

economical to exchange it for a new or factory-reconditioned one, rather than renew worn components on the original unit.

Brush renewal (Marelli alternator)

- 2 Unscrew the nuts and take off the rear cover.
- 3 Unscrew the two small bolts and withdraw the brush holder (photos).
- 4 Fit the new brush holder which is supplied complete with brushes, by reversing the removal operations.

Brush renewal (Bosch alternator)

- 5 Where applicable, remove the radio suppression condenser (capacitor) from the rear end frame (one screw and washer, and a plug-in connection).
- 6 Undo the two screws which retain the brush holder to the rear frame of the alternator, then

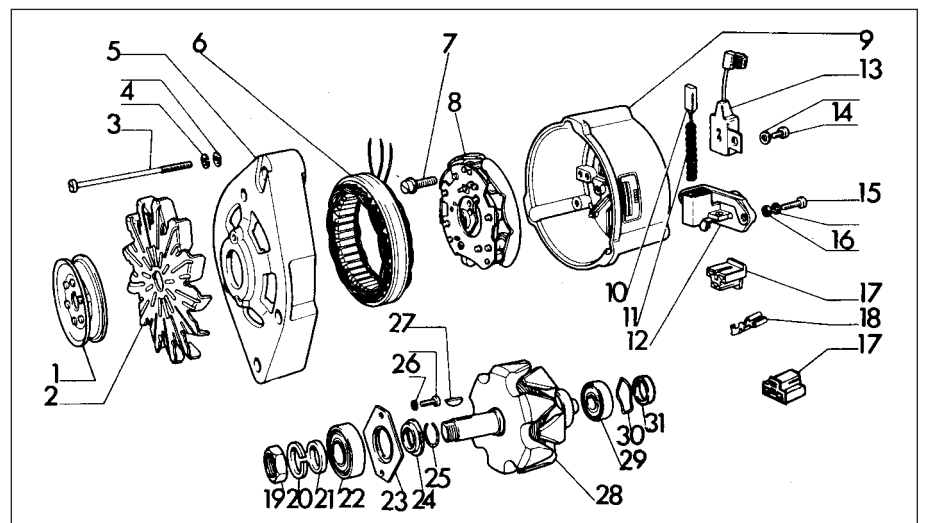


Fig. 9.1 Exploded view of typical alternator (Sec 5)

- | | | | |
|--------------------------------|-----------------------|-----------------------|------------------------------|
| 1 Pulley | 9 Body | 16 Screws and washers | 24 Thrust ring |
| 2 Fan | 10 Brush | 17 Plug socket | 25 Spring washer |
| 3 Bolts | 11 Spring | 18 Suppressor | 26 Screw and washer |
| 4 Washers | 12 Brush holder | 19 Shaft nut | 27 Key |
| 5 Drive-end bracket | 13 Condenser | 20 Spring washer | 28 Rotor |
| 6 Stator windings | 14 Screws and washers | 21 Thrust ring | 29 Bearing |
| 7 Plate screw | 15 Screws and washers | 22 Bearing | 30 Backing washer |
| 8 Diode plate (rectifier pack) | | 23 Retainer plate | 31 Shield (where applicable) |



8.2 Starter motor connections



8.3 Removing starter motor

ease the holder out of the alternator. Inspect the brushes and if worn below the specified minimum length, they must be renewed.

7 Disconnect the brush leads by unsoldering or carefully cutting them.

8 When soldering the new brush leads, do not allow solder to run down them or their flexibility will be ruined.



Gripping the brush leads with a pair of pliers to act as a heat sink will prevent heat transfer to the internal components of the alternator.

9 When inspecting or renewing brushes, check the surface of the slip rings. Clean them with solvent or if they are very discoloured, use very fine glasspaper.

6 Voltage regulator

1 This is of integral type and is part of the brushholder assembly.

2 No provision is made for adjustment or overhaul.

7 Starter motor - description and testing

1 The starter motor may be one of two different makes. Both are of pre-engaged type.

2 This type of starter motor incorporates a solenoid mounted on top of the starter motor body. When the ignition switch is operated, the solenoid moves the starter drive pinion, through the medium of the shift lever, into engagement with the flywheel starter ring gear. As the solenoid reaches the end of its stroke, and with the pinion by now partially engaged with the flywheel ring gear, the main fixed and moving contacts close and engage the starter motor to rotate the engine.

3 This pre-engagement of the starter drive does much to reduce the wear on the flywheel ring gear associated with inertia type starter motors.

4 If the starter fails, some fault-finding can be done with it still on the car. Check the ignition warning light comes on, and does not go out when the starter is switched on. If it goes out, the fault is probably in the battery. If it stays bright, get an assistant to work the switch,

whilst listening to the starter. Listen to find out if the solenoid clicks into position. If it does not, pull off the solenoid wire, and check it with a test bulb. If the wire is live when the key is turned, but the solenoid does not move, take off the starter and remove it to the bench for overhaul.

8 Starter motor - removal and refitting

1 Disconnect the battery negative lead.

2 Disconnect the lead from the starter motor (photo).

3 Unscrew the fixing bolts and withdraw the starter motor, downwards on 1116 cc and 1301 cc models (photo).

4 Refitting is a reversal of the removal procedure.

9 Starter motor - overhaul

1 As with the alternator, the operations should normally be limited to renewal of the brushes. If the unit has covered a high mileage it will usually be more economical to purchase a new or factory-reconditioned one rather than renew several components of the original unit.

2 Owing to the possibility that a fault can develop in the starter motor solenoid or drive assembly, full dismantling procedures are given later in this Section.

Brush - renewal

3 Slide off the cover band.

4 Using a hooked piece of wire, pull up the springs so that the brushes can be withdrawn and their lengths checked for wear. If they have worn below the specified minimum length, renew them by extracting the brush lead connecting screws (photo).

Solenoid

5 Disconnect the field connecting wire from the solenoid.

6 Unscrew the bolts which hold the solenoid to the end-frame.

7 Unscrew the yoke tie-rod nuts.

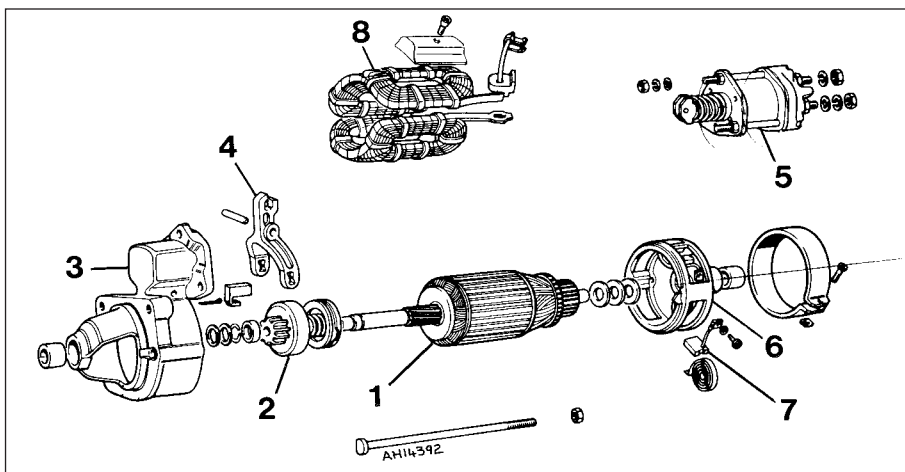


Fig. 9.2 Exploded view of typical starter motor (Sec 9)

- | | | | |
|-----------------------|---------------------|------------------|------------------|
| 1 Armature | 3 Drive end bracket | 5 Solenoid | 7 Brush |
| 2 Drive pinion/clutch | 4 Shift lever | 6 Brush endplate | 8 Field windings |



9.4 Starter motor brush partly withdrawn



9.8 Starter motor dismantled

8 Withdraw the solenoid and yoke off the armature and from the drive end bracket. Note the steel and fibre washers and the shims on the armature shaft (photo).

9 Extract the split pin and tap out the engagement lever pivot pin.

10 Pull the rubber packing piece from the drive end bracket.

11 Withdraw the armature with solenoid plunger, coil spring and engagement lever.

12 Clean the commutator with a fuel soaked rag or very fine glass paper. *Do not undercut the mica insulators on the commutator.*

Drive

13 To remove the drive assembly from the armature shaft, use a piece of tubing to tap the stop collar down the shaft to expose the snap ring. Remove the snap ring and stop collar and slide the drive assembly from the shaft.

14 Refitting is a reversal of removal, but use a new snap ring to secure the drive to the armature shaft.

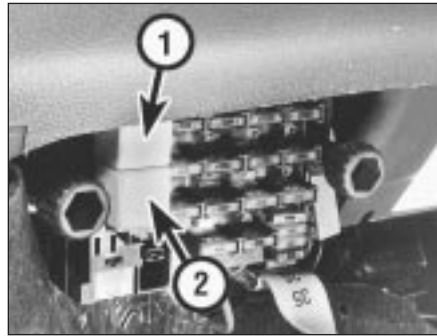
10 Fuses and relays



1 The fuse box is located under the left-hand side of the fascia panel and is held in place by two hand screws (photo).



12.1 Courtesy lamp switch



10.1 Fuse block (later models)

- 1 Horn relay
- 2 Heated tailgate window relay

2 The fuses and the circuits protected are identified by symbols. Refer also to Specifications.

3 If a fuse blows, always renew it with one of identical rating. If the new fuse blows immediately, find the cause before renewing the fuse for the second time. This is usually due to defective wiring insulation causing a short circuit.

4 Never substitute a piece of wire or other makeshift device for a proper fuse.

5 Various relays are plugged into the fuse block and include those for the heated rear screen, heater and horns.

6 On cars fitted with power-operated front windows and centralised door locking, the fuses and relays for these circuits are mounted separately under the right-hand side of the fascia panel.

7 The relay (flasher unit) for the direction indicators and hazard warning lamps is located on the lower part of the steering column combination switch and is accessible after removing the column shroud.

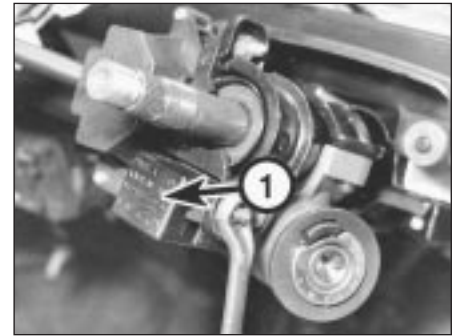
11 Steering column combination switch



- 1 Disconnect the battery negative lead.
- 2 Remove the steering column shrouds.



13.4 Switch panel screw



11.4 Unscrewing steering column switch clamp nut

- 1 Direction indicator flasher unit (relay)

3 The switch can be removed without having to take off the steering wheel, but for clarity, the photographs show the wheel removed.

4 Unscrew the switch clamp nuts, disconnect the wiring plug and remove the switch from the steering column (photo).

5 Refitting is a reversal of removal, but make sure that the activating projections on the steering wheel hub engage correctly with the switches.

12 Courtesy lamp switch



1 These are located in and secured to the body pillars with a single screw (photo).

2 Disconnect the battery negative lead.

3 Extract the switch screw and withdraw the switch.

4 If the leads are to be disconnected, tape them to the pillar to prevent them from slipping inside.

5 Refitting is a reversal of removal. Apply petroleum jelly to the switch contacts to prevent corrosion.

13 Rocker and push-button switches



1 These are mounted in panels on each side of the instrument panel.

2 Disconnect the battery negative lead.

3 Prise off the instrument panel hood cover. This is held in place by clips. The careful use of a screwdriver will assist in releasing them (see Section 21).

4 Extract the switch panel fixing screws. These compress spring clips which in turn secure the switch panel (photo).

5 Withdraw the switch panel until the wiring plugs can be disconnected. Record the location of the plugs before disconnecting



13.5A Withdrawing switch panel



13.5B Switch panel fibre optic



14.2A Tailgate contact block



14.2B Body contact block



16.1 Headlamp plug and rubber cover



16.2A Headlamp bulbholder spring clips

them. Carefully release the fibre optic filaments (photos).

6 A push-button switch can be removed by compressing its retaining tabs and pushing it from the panel.

7 A rocker switch can be removed if its knob is pulled off and the switch sections withdrawn from the panel.

8 Reassembly and refitting of both types of switches are reversals of removal and dismantling.

14 Tailgate contacts



1 Contact blocks are used to transmit power to the heated tailgate window and to the wiper motor.

2 The block on the tailgate or the body may be released by prising their ends with a screwdriver (photos).

15 Horns



1 These are mounted close to the engine/transmission left-hand mounting below the radiator.

2 Apart from keeping the connecting leads secure, no maintenance or adjustment is required.



16.2B Headlamp halogen type bulb

16 Headlamp bulb - renewal



1 Open the bonnet and pull off the plug and the rubber cover from the rear of the headlamp (photo).

2 Prise back the spring bulbholder clips and withdraw the combined bulb and holder (photos).

3 Refit the new bulb. Avoid fingering it if it is of halogen type. Should the fingers touch the bulb, wipe it with a rag soaked in methylated spirit to remove any residual grease.

4 Turn the bulbholder until the pip on its flange engages in the cut-out in the rim of the reflector.

5 Snap back the spring retaining clips, refit the rubber cover and reconnect the plug.

17 Headlamp beam - alignment



1 It is recommended that the headlamp beams are aligned by your dealer or a service station having optical setting equipment.

2 Where an owner wishes to do the job himself, proceed in the following way.

3 Have the car standing on a level floor with

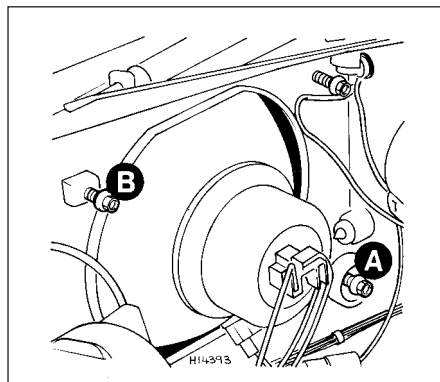


Fig. 9.3 Headlamp beam adjustment screws (Sec 17)

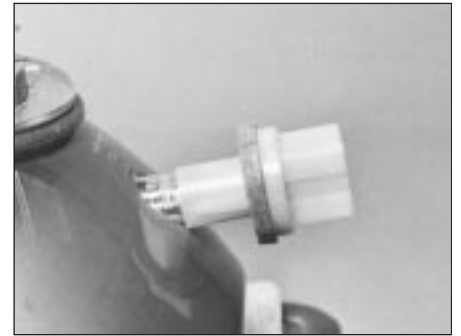
A Vertical B Horizontal



18.1 Headlamp upper fixing screw



18.2 Withdrawing headlamp



19.2 Front parking lamp bulb

the tyres correctly inflated and square to a wall, at a distance of 10.0 m (32.8 ft) from it.
 4 Mark the wall to correspond with the centres of the headlamps.
 5 Switch to dipped beams when the brightest parts of the light pattern should be below the marks on the wall by an amount equal to one tenth of the distance between the floor and the mark on the wall.
 6 Adjust the beams as necessary by turning the adjuster screws (A) vertical or (B) horizontal, which are located at the rear of the headlamp.

18 Headlamp - removal and refitting



1 Open the bonnet and extract the two headlamp mounting screws from the top rail (photo).
 2 Pull the headlamp unit forward off its ballstud and then disconnect the wiring plug (photo).
 3 Refitting is a reversal of removal.

19 Exterior lamps - bulb renewal



Front parking lamp

1 The bulbholder is located in the headlamp reflector.

2 Open the bonnet, push and twist the bulbholder from its location (photo).
 3 The wedge base type bulb is simply pulled from its holder.

Front direction indicator lamp

4 Extract the screws and remove the lens (photo).
 5 Depress and twist the bayonet fitting type bulb from its holder.

Side repeater lamp

6 This bulb may be renewed in one of two ways. Either partially remove the underwing protective shield and reach up under the front wing and pull the holder out of the lamp body or depress the lamp retaining tab and withdraw the lamp from outside the wing. The tab is very brittle (photo).

7 Remove the bulb from the holder.

Rear lamp cluster

8 Open the tailgate.
 9 Gently prise up the clips on the top surface of the lens. Pull the upper part of the lens outwards and release it from the lower fixings (photo).
 10 The individual lamp bulbs may be renewed, all of them being of bayonet fitting type (photo).

Rear number plate lamp

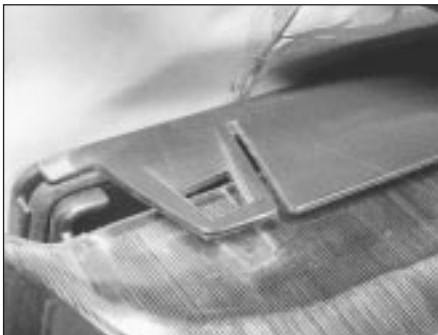
11 Insert a screwdriver blade in the lens slot and prise it from the bulb holder. Withdraw the bulb.
 12 If preferred, the complete lamp may be removed from the bumper by reaching up under the bumper and squeezing the lamp retaining tabs (photo).



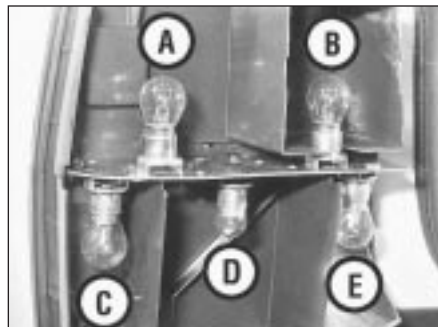
19.4 Front direction indicator lamp lens and bulb



19.6 Side repeater lamp

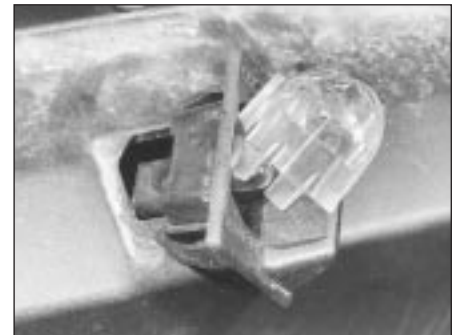


19.9 Rear lamp lens upper clip

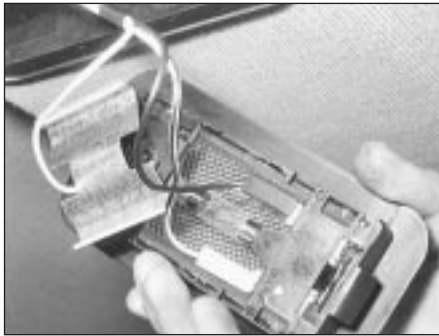


19.10 Rear lamp bulbs

A Direction indicator C Stop E Fog
 B Reversing D Tail



19.12 Rear number plate lamp withdrawn



20.1 Interior roof lamp withdrawn



20.3 Instrument panel warning lamp

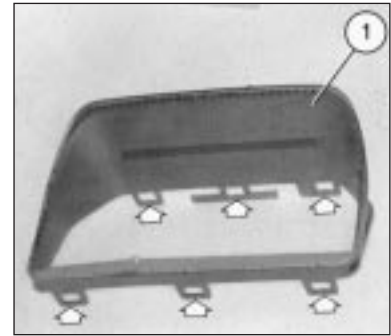


Fig. 9.4 Instrument hood cover (1) (Sec 21)

20 Interior lamps - bulb renewal

Courtesy lamp

- 1 The lamp lenses, whether roof or pillar mounted, are removed by prising off using a screwdriver inserted under one end (photo).
- 2 The festoon type bulb is pulled from its spring contacts.

Instrument panel lamps

- 3 Remove the instrument panel hood cover as described in the next Section. The panel lighting bulbs may be renewed without further dismantling, but access to the warning and indicator bulbs can only be obtained if the instrument panel is partially withdrawn as described in the next Section (photo).



21.2 Removing instrument panel hood cover



21.3 Removing instrument panel screw

- 4 Pull out the appropriate bulbholder and withdraw the wedge base type bulb.
- 5 Fit the new bulb, the holder, instrument panel and hood cover.

21 Instrument panel - removal and refitting

- 1 Disconnect the battery negative lead.
- 2 Remove the instrument panel hood cover. The easiest way to do this is to insert the fingers at the sides, and pull the hood sharply upwards off its retaining clips.
- 3 Extract the two fixing screws from the instrument panel and pull it towards you until the speedometer drive cable can be disconnected by squeezing its plastic retaining ring (photo).
- 4 Disconnect the wiring plugs and record their exact locations.

- 5 Remove the instrument panel upwards (photo).
- 6 Refitting is a reversal of removal.

22 Instrument panel - dismantling

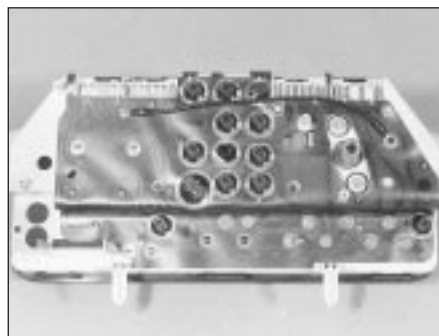
- 1 With the instrument panel removed from the car, individual instruments may be removed in the following way.
- 2 Pull off the speedometer trip device knob.
- 3 Remove the instrument hood cover by gently releasing the plastic clips (Fig. 9.4).
- 4 The speedometer is secured by two screws for its metal casing and one screw for its plastic casing. Other instruments are held to the panel by nuts (photo).
- 5 On models equipped with a check control system (see Section 34), the speedometer cannot be removed until the control unit has first been withdrawn.
- 6 On ES versions, the speedometer cannot be removed until the economy gauge control unit has been removed.

23 Speedometer drive cable - renewal

- 1 Remove the instrument panel hood cover as described in Section 21.
- 2 Disconnect the speedometer cable from the speedometer by squeezing the plastic retaining ring (photo).



21.5 Instrument panel and steering wheel removed



22.4 Rear view of instrument panel



23.2 Speedometer cable connector at head



23.3 Speedometer cable connector at transmission

- 3 Working at the transmission, disconnect the speedometer cable by unscrewing the knurled retaining ring (photo).
- 4 Withdraw the cable through the bulkhead grommet.
- 5 Refit the new cable assembly by reversing the removal operations.

24 Windscreen wiper blade and arm - removal and refitting



- 1 The wiper blade can be removed once the arm has been pulled away from the glass and locked in position.
- 2 Depress the small tab (A) and push the U-shaped carrier out of the hook (B) of the



25.4 Removing windscreen wiper motor mounting screws



25.5A Windscreen wiper motor cover



24.4 Windscreen wiper arm nut

- wiper arm. The blade can then be withdrawn, passing the wiper arm hook through the slot (C) in the blade stretcher (Fig. 9.5).
- 3 Before removing the wiper arm, it is worthwhile sticking a strip of masking tape on the screen to indicate the setting of the arm and blade as a guide to refitting.
 - 4 Flip up the plastic cover and unscrew the arm retaining nut. Pull off the arm from the splined drive spindle (photo).
 - 5 Refitting is a reversal of removal.

25 Windscreen wiper motor - removal and refitting



- 1 Open the bonnet and disconnect the battery negative lead.
- 2 Remove the wiper arm and blade as previously described.
- 3 Prise off the sealing cover from around the drive spindle and then unscrew the drive spindle bezel nut.
- 4 Pull back the weathersealing strip from above the wiper motor location and remove the two screws which are exposed (photo).
- 5 Withdraw the motor/gearbox with protective cover from under the lip of the upper bulkhead. Disconnect the wiring plug (photos).
- 6 Refitting is a reversal of removal.



25.5B Removing windscreen wiper motor

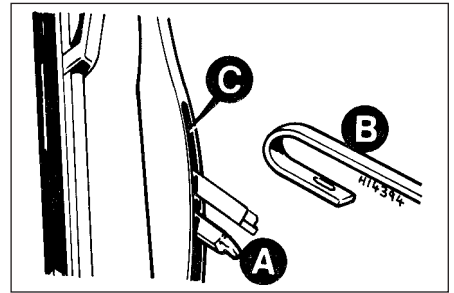


Fig. 9.5 Windscreen wiper blade fixing (Sec 24)

A Tab B Wiper arm C Blade slot

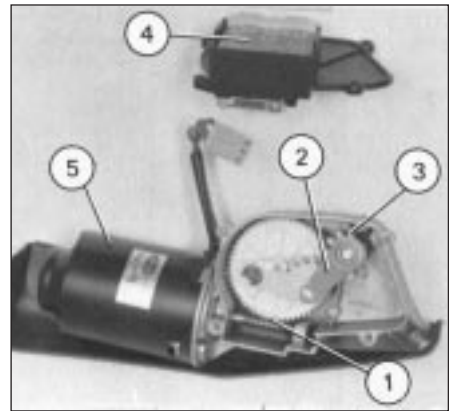


Fig. 9.6 Windscreen wiper motor components (Sec 25)

- | | |
|--------------|-----------------------------|
| 1 Gears | 4 Intermittent control unit |
| 2 Crank arm | 5 Motor yoke |
| 3 Shaft gear | |

26 Tailgate wiper blade and arm - removal and refitting



- 1 Pull the wiper arm from the glass until it locks.
- 2 With the thumb nail pull down the tab to release the peg (B) from the hole (A) (Fig. 9.7). Pull the blade from the arm.
- 3 To remove the arm, flip up the plastic cover and remove the nut exposed. Pull the arm from the drive spindle.
- 4 Refitting is a reversal of removal.

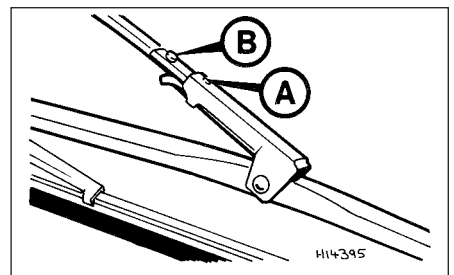


Fig. 9.7 Tailgate wiper blade fixing (Sec 26)

A Hole B Peg



27.4 Tailgate wiper motor



28.1 Washer fluid reservoir



28.2 Washer pumps

27 Tailgate wiper motor - removal and refitting



- 1 Remove the blade and arm as previously described. Unscrew the drive spindle bezel nut.
- 2 Open the tailgate fully.
- 3 Unclip and remove the wiper motor cover.
- 4 Unscrew the mounting screws, withdraw the motor and disconnect the wiring plug (photo).
- 5 Refitting is a reversal of removal.

28 Washer system



- 1 The washer system for the windscreen and the tailgate operates from a bag type fluid reservoir within the engine compartment (photo).
- 2 The reservoir bag is fitted with two pumps, one for each system (photo).
- 3 Use screen cleaning fluid mixed in the recommended proportion in the washer fluid reservoir and in very cold weather add a small quantity of methylated spirit.
- 4 To clear a blocked washer jet nozzle or to adjust the wash jet glass-striking pattern, insert a pin part way into the jet nozzle.

29 Heated tailgate window - precautions and repair



- 1 The heater element inside the tailgate glass should be treated with care.
- 2 Clean only with a damp cloth and wipe in the direction in which the filaments run. Avoid scratching with rings on the fingers, or by allowing luggage to rub on the glass. Never stick adhesive labels over the heater element.
- 3 Should one of the heater filaments be broken it can be repaired using one of the special silver paints available, but follow the manufacturer's instructions carefully.

30 Radio/cassette - fitting



- 1 In-car entertainment equipment is not provided as standard on the models covered by this Manual.
- 2 However, the centre console is designed to receive a radio set after removing the blanking plate behind which a power lead is already provided.
- 3 The ignition system and other electrical components are suppressed during production of the car and further suppression should not be required other than earthing the wiper motor.

Receiver

- 4 Fit the radio/cassette using the installation kit supplied with the equipment.
- 5 On Comfort models, fit an in-line fuse in the power feed. On Super models the radio supply is protected by fuse number 12.
- 6 Make sure that the radio is well earthed to a metal body component.

Aerial

- 7 The recommended locations for the aerial are towards the rear of the right-hand front wing or on the windscreen pillar.
- 8 Fitting instructions for Fiat aerials are supplied with them, but the following general advice will help if using non-Fiat equipment.

9 Motorised automatic aerials rise when the equipment is switched on and retract at switch-off. They require more fitting space and supply leads, and can be a source of trouble.

10 There is no merit in choosing a very long aerial as, for example, the type about three metres in length which hooks or clips on to the rear of the car, since part of this aerial will inevitably be located in an interference field. For VHF/FM radios the best length of aerial is about one metre. Active aerials have a transistor amplifier mounted at the base and this serves to boost the received signal. The aerial rod is sometimes rather shorter than normal passive types.

11 A large loss of signal can occur in the aerial feeder cable, especially over the Very High Frequency (VHF) bands. The design of feeder cable is invariably in the co-axial form, ie a centre conductor surrounded by a flexible copper braid forming the outer (earth) conductor. Between the inner and outer conductors is an insulator material which can be in solid or stranded form. Apart from insulation, its purpose is to maintain the correct spacing and concentricity. Loss of signal occurs in this insulator, the loss usually being greater in a poor quality cable. The quality of cable used is reflected in the price of the aerial with the attached feeder cable.

12 The capacitance of the feeder should be within the range 65 to 75 picofarads (pF) approximately (95 to 100 pF for Japanese and American equipment), otherwise the adjustment of the car radio aerial trimmer may not be possible. An extension cable is necessary for a long run between aerial and receiver. If this adds capacitance in excess of the above limits, a connector containing a series capacitor will be required, or an extension which is labelled as "capacity-compensated".

13 Fitting the aerial will normally involve making a 7/8 in (22 mm) diameter hole in the bodywork, but read the instructions that come with the aerial kit. Once the hole position has been selected, use a centre punch to guide the drill. Use sticky masking tape around the area for this helps with marking out and drill location, and gives protection to the

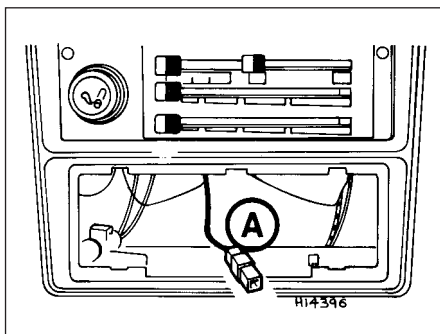


Fig. 9.8 Radio housing and power lead (A) (Sec 30)

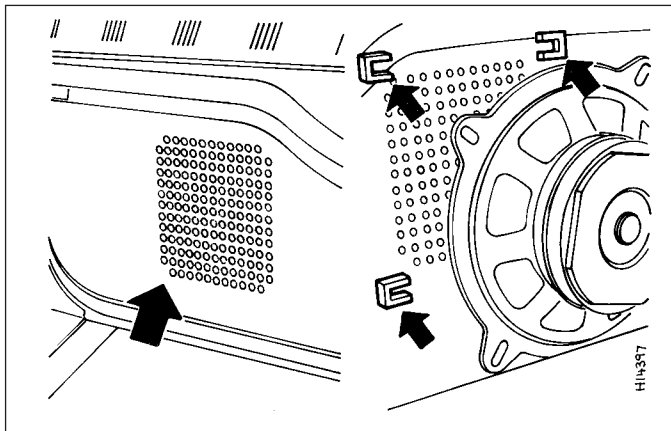


Fig. 9.9 Door speaker mounting (Sec 30)

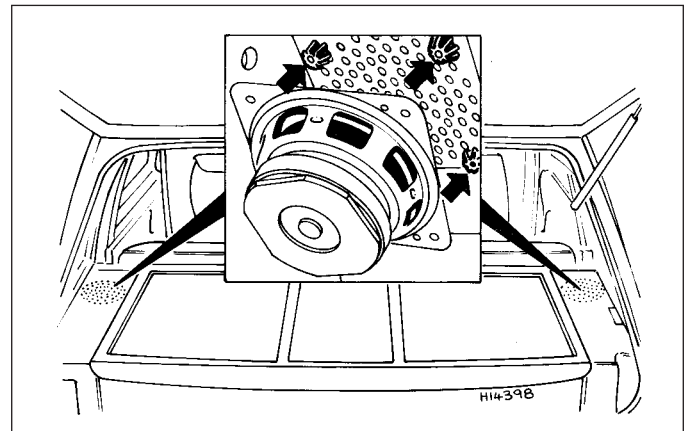


Fig. 9.10 Rear speaker mounting (Sec 30)

paintwork should the drill slip. Three methods of making the hole are in use:

- a) Use a hole saw in the electric drill. This is, in effect, a circular hacksaw blade wrapped round a former with a centre pilot drill.
- b) Use a tank cutter which also has cutting teeth, but is made to shear the metal by tightening with an Allen key.
- c) The hard way of drilling out the circle is using a small drill, say 1/8 in (3 mm), so that the holes overlap. The centre metal drops out and the hole is finished with round and half-round files.

14 Whichever method is used, the burr is removed from the body metal and paint removed from the underside. The aerial is fitted tightly ensuring that the earth fixing, usually a serrated washer, ring or clamp, is making a solid connection. *This earth connection is important in reducing interference.* Cover any bare metal with primer paint and topcoat, and follow by underseal if desired.

15 Aerial feeder cable routing should avoid the engine compartment and areas where stress might occur, eg under the carpet where feet will be located.

Loudspeakers

- 16 A mono speaker may be located under the fascia panel beneath the glovebox.
- 17 Provision is made for twin speakers within the door tidy bins or under the rear shelf mountings.
- 18 Speakers should be matched to the output stage of the equipment, particularly as regards the recommended impedance. Power transistors used for driving speakers are sensitive to the loading placed on them.

- 4 Release the bolts which connect the power lift to the glass mounting.
- 5 Remove the bolts which hold the lift assembly to the door.
- 6 The motor and glass mounting may be disconnected from the cable guide and sleeve and any faulty components renewed.
- 7 When refitting the assembly to the door, make sure that the window glass slides smoothly before fully tightening the cable guide bolts. Refer to Section 10 for details of system fuses and relays.

31 Electrically-operated front door windows



- 1 The electrically-operated front door windows are controlled by switches on the centre console or in the door armrest (depending on model). The regulator motor and cable are located within the door cavity.
- 2 To gain access to the assembly, remove the door trim panel as described in Chapter 12.
- 3 Disconnect the wiring plug (1) (Fig. 9.11).

32 Central door locking system



- 1 The doors are locked simultaneously from the outside by turning the key in either direction.
- 2 The doors can be locked from inside the car in the following ways:
All doors locked or unlocked - depress or lift a front door lock plunger knob.
One rear door locked or unlocked - depress or lift a rear door lock plunger knob.

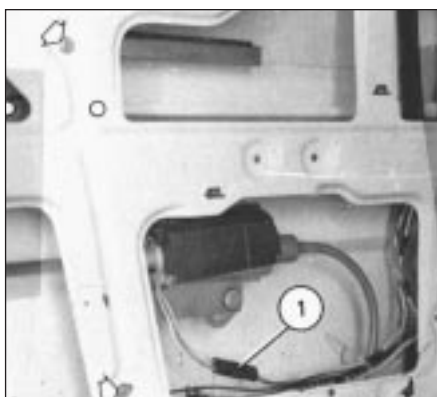


Fig. 9.11 Power-operated window motor (Sec 31)

- 1 Connector plug

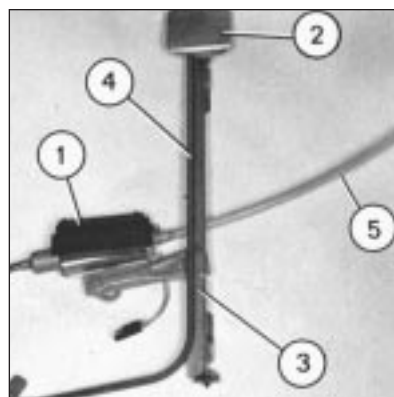


Fig. 9.12 Power operated window components (Sec 31)

- 1 Electric motor
- 2 Glass mounting
- 3 Cable guide
- 4 Cable
- 5 Cable sleeve

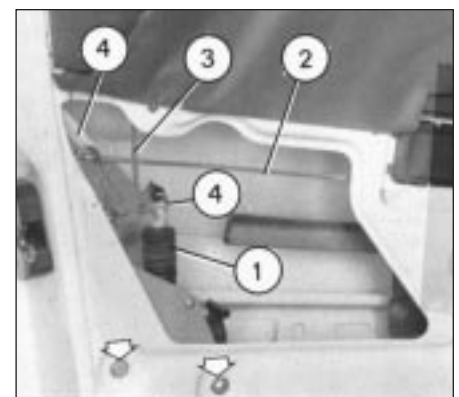


Fig. 9.13 Central door locking system components (Sec 32)

- 1 Solenoid
- 2 Lock relay lever
- 3 Link rod
- 4 Exterior handle lever

- 3 The centralised door locking system can operate independently of the key.
- 4 To gain access to the lock solenoid and linkage, remove the front door trim panel as described in Chapter 12.
- 5 Disconnect the battery negative lead.
- 6 Disconnect the electrical wiring plugs from the solenoid within the door cavity.
- 7 Disconnect the solenoid from the lock lever by removing the clip.
- 8 Unscrew the two bolts which secure the solenoid to the door and remove it.
- 9 Renew the solenoid or switch as necessary.
- 10 Refitting is a reversal of removal.
- 11 Refer to Section 10 for details of system fuses and relays.

33 Economy gauge (Econometer)



- 1 This device is fitted to ES (energy saving) models and indicates to the driver the fuel consumption (in litres per 100 km) coupled with a needle which moves over coloured sections of a dial to make the driver aware that his method of driving is either conducive to high or low fuel consumption. Refer to Chapter 3, Section 16.
- 2 The device is essentially a vacuum gauge which also incorporates a warning lamp to indicate to the driver when a change of gear is required.
- 3 A fuel cut-out valve (see Chapter 3, Section 11) is used in conjunction with the economy gauge so that when the accelerator pedal is released during a pre-determined engine speed range, fuel supply to the engine is stopped, but resumes when the engine speed falls below the specified range.

LED (light emitter diode)

- 4 The gearchange indicator will only light up at engine speeds in excess of 2000 rev/min for vacuum pressures up to 600 mm Hg in 1st, 2nd and 3rd speed gears and for vacuum pressures up to 676 mm Hg in 4th speed

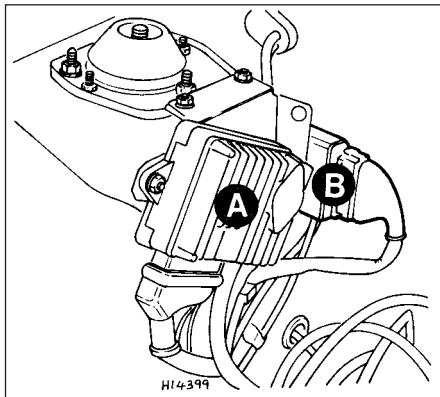


Fig. 9.14 Location of control units (Sec 33)

- A Digiplex ignition system control unit
- B Fuel cut-out valve control unit

- gear. The light will not come on if 5th speed gear is engaged or if the coolant temperature is below 55°C.
- 5 There is a two second delay in the light coming on to prevent it operating during rapid acceleration in a low gear.
- 6 If the LED light comes on during deceleration it should be ignored.

Fault finding

- 7 A faulty economy gauge should be checked in the following way.
- 8 Refer to Section 21 and remove the instrument panel.
- 9 Disconnect the economy gauge L connector and then connect a test lamp between the BN cable contact and earth. If the lamp comes on then the gauge supply circuit is not open. If the lamp does not come on, check all connections in the supply cable which comes from the interconnecting unit of the electrical system, also Fuse No 12.
- 10 Now connect a voltmeter between the white cable and earth. Check the voltage with the engine not running, but the ignition switched on. It should be between 0.7 and 0.9 volt. If the reading varies considerably from that specified, check the connections between the economy gauge and the fuel cut-out device control unit. If the fault cannot be rectified, renew the ignition control unit (Digiplex system, see Chapter 4).
- 11 Now check the closed throttle valve plate switch by connecting a voltmeter between the brown and BN cables of the L connector. With the valve plate open, there should be no reading, but with it open, voltage should be indicated.
- 12 Failure to conform as described will be due to a faulty earth in the switch or a faulty fuel cut-out device control unit.
- 13 A further test of the throttle valve plate switch may be carried out by disconnecting the multi-plug from the fuel cut-out device control unit.
- 14 Connect a test lamp to contact 4 (positive battery terminal). The lamp should come on, when the engine is idling or the accelerator released. If it does not, renew the throttle valve plate switch.

- 15 Connect a tachometer to the brown/white cable contact in the L connector and record the engine speed with the engine running. If no reading is obtained, renew the Digiplex ignition control unit which must be faulty.

34 Check control (warning module) system



- 1 This is fitted into the instrument panel of certain models to provide a means of checking the operation of many electrical circuits and other systems in the interest of safety. Sensors are used where appropriate.
- 2 The following components are not monitored by the system, but have separate warning lamps:

- Handbrake "on"
- Choke in use
- Low engine oil pressure
- Battery charge indicator

- 3 The multi-functional electronic device automatically checks the following functions whether the engine is running or not:

- Coolant level
- Disc pad wear
- Door closure
- Engine oil level
- Front parking lamps
- Rear foglamps
- Stop lamps

- 4 The check information is stored by the system monitor until the engine is started when the display panel then indicates the situation by means of the LEDs (light emitter diodes) and the general lamp.

- 5 If all functions are in order, the green panel lamp will come on when the ignition key is turned and will go out after two to three seconds.

- 6 If some functions are not in order, then the red panel lamp will come on also the appropriate LED.

Sensors - checking

- 7 If a fault signal occurs which is subsequently found to be incorrect, first check the wiring connections between the

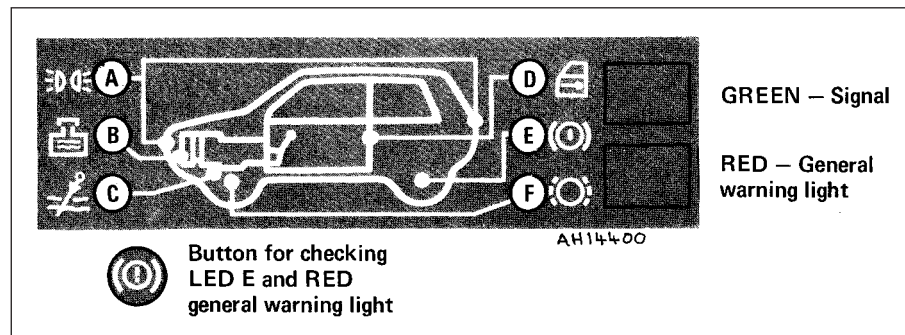


Fig. 9.15 Check system control panel (Sec 34)

- A Parking lamps
- B Coolant level
- C Engine oil level
- D Door closure
- E Brake fluid level
- F Disc pad wear

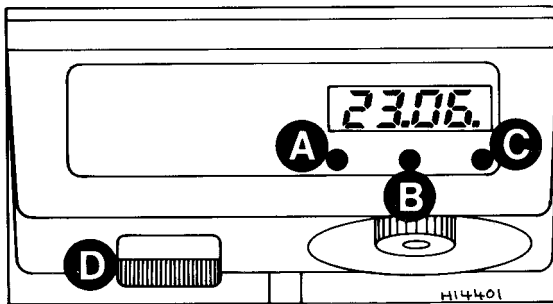


Fig. 9.16 Digital clock controls (Sec 35)

A Control button - hour setting

B Control button - display (ignition off)

C Control button - minute setting

D Map reading lamp switch

sensors, lamp circuits and the control unit. Corrosion at the terminals may also be a contributory cause.

8 Never short circuit a sensor supply wire or the electronic module will be damaged.

Check control unit and monitor - removal and refitting

9 Remove the instrument panel as described in Section 21.

10 Unbolt the control unit housing from the instrument panel.

11 Access to the monitor can only be obtained after removing the tachometer and

the red and green general warning lamps. Unscrew the two monitor fixing bolts.

35 Clocks - setting

Quartz type

1 To set the hands, depress the knob and turn it.

Digital type

2 To set the clock, depress button A to

display minutes and seconds and again to display hours and minutes.

3 To correct the hour setting, press button C then button A and release it at the correct time. Depress button C three times to display hours and minutes.

4 To correct the minute setting, depress button C twice. Depress button A and release it when the correct time is shown. Depress button C twice to display hours and minutes.

5 To correct the second setting, depress button C three times. Depress button A and hold it depressed to zero the seconds then release the button. Depress button C to display the hours and minutes.

6 Switch D, Fig. 9.16 operates the map reading lamp fitted to SX models in conjunction with the digital clock.

36 Cigar lighter

1 This device can be operated without switching on the ignition.

2 Push in the knob and when it springs out it is ready for use.

3 The cigar lighter socket may be used as a power source provided the rating of the accessory does not exceed 100 watts.

Fault finding overleaf

Fault finding - electrical system

No voltage at starter motor

- Battery discharged
- Battery defective internally
- Battery terminals loose or earth lead not securely attached to body
- Loose or broken connections in starter motor circuit
- Starter motor switch or solenoid faulty

Voltage at starter motor - faulty motor

- Starter brushes badly worn, sticking, or brush wires loose
- Commutator dirty, worn or burnt
- Starter motor armature faulty
- Field coils earthed

Starter motor noisy or rough in engagement

- Pinion or flywheel gear teeth broken or worn
- Starter drive main spring broken
- Starter motor retaining bolts loose

Alternator not charging*

- Drivebelt loose and slipping, or broken
- Brushes worn, sticking, broken or dirty
- Brush springs weak or broken

* If all appears to be well but the alternator is still not charging, take the car to an automobile electrician for checking of the alternator

Ignition light fails to go out, battery runs flat in a few days

- Drivebelt loose and slipping, or broken
- Alternator faulty

Battery will not hold charge for more than a few days

- Battery defective internally
- Electrolyte level too low or electrolyte too weak due to leakage
- Plate separators no longer fully effective
- Battery plates severely sulphated
- Drivebelt slipping
- Battery terminal connections loose or corroded
- Alternator not charging properly
- Short in lighting circuit causing continual battery drain

Fuel gauge gives no reading

- Fuel tank empty!
- Electric cable between tank sender unit and gauge earthed or loose
- Fuel gauge case not earthed
- Fuel gauge supply cable interrupted
- Fuel gauge unit broken

Fuel gauge registers full all the time

- Electric cable between tank unit and gauge broken or disconnected

Horn operates all the time

- Horn push either earthed or stuck down
- Horn cable to horn push earthed

Horn fails to operate

- Blown fuse
- Cable or cable connection loose, broken or disconnected
- Horn has an internal fault

Horn emits intermittent or unsatisfactory noise

- Cable connections loose
- Horn incorrectly adjusted

Lights do not come on

- If engine not running, battery discharged
- Light bulb filament burnt out or bulbs broken
- Wire connections loose, disconnected or broken
- Light switch shorting or otherwise faulty

Lights come on but fade out

- If engine not running, battery discharged

Lights give very poor illumination

- Lamp glasses dirty
- Reflector tarnished or dirty
- Lamps badly out of adjustment
- Incorrect bulb with too low wattage fitted
- Existing bulbs old and badly discoloured
- Electrical wiring too thin not allowing full current to pass

Lights work erratically, flashing on and off, especially over bumps

- Battery terminals or earth connections loose
- Lights not earthing properly
- Contacts in light switch faulty

Wiper motor fails to work

- Blown fuse
- Wire connections loose, disconnected or broken
- Brushes badly worn
- Armature worn or faulty
- Field coils faulty

Wiper motor works very slowly and takes excessive current

- Commutator dirty, greasy or burnt
- Drive spindle binding or damaged
- Armature bearings dry or unaligned
- Armature badly worn or faulty

Wiper motor works slowly and takes little current

- Brushes badly worn
- Commutator dirty, greasy or burnt
- Armature badly worn or faulty

Wiper motor works but wiper blade remains static

- Drive spindle damaged or worn
- Wiper motor gearbox parts badly worn