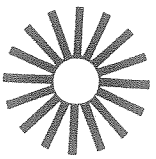
1992 SOLECTRIA FORCE
2-DOOR SEDAN SERVICE MANUAL

FOREWORD

This manual has been prepared as a supplement to the service information contained in the Geo Service Manual. Information contained in this manual is based on the latest product information available at the time of publication. The right is reserved to make changes at any time without notice.



SOLECTRIA CORPORATION
27 JASON STREET
ARLINGTON, MA 02174 USA
508-658-2231 · FAX 508-658-3224

INTRODUCTION

This manual section contains a description of the Selectria Force automobile and its major features, and a listing of other related service publications. For operating information, refer to the Solectria Force Owners Manual.

Description

The Selectria Force is a Geo Metro that has been modified by the replacement of the internal combustion engine with the Solectria electric drive. The 3-phase induction drive motor and associated controller receive electric power from a self-contained lead acid battery. The battery is recharged from any 120Vac 60Hz outlet. Optional solar cells, mounted on the top of the vehicle, are also employed to recharge the battery. The car utilizes either the Geo 5-speed manual transmission, or a Solectria automatic transmission.

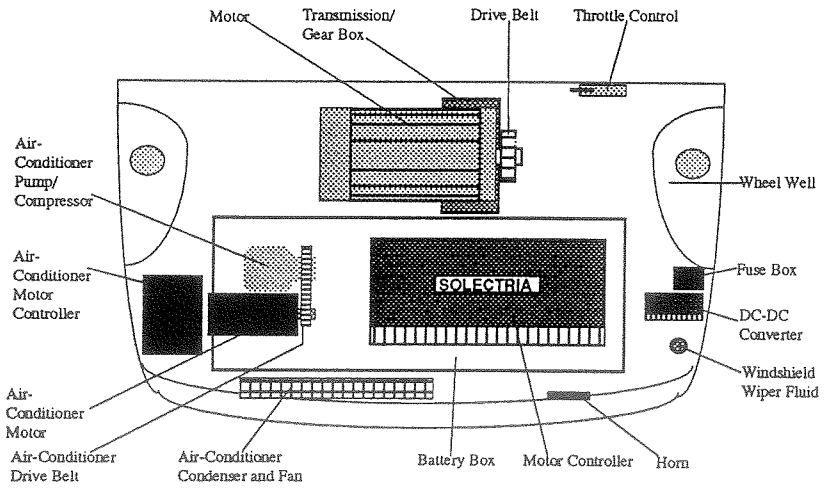


DIAGRAM OF EQUIPMENT UNDER THE HOOD FOR SOLECTRIA FORCE AUTOMATIC

Additional Service Information

The Geo Metro Service Manual ST370 and The Geo Metro electrical diagnosis manual ST370 EDM should be consulted for service information on all parts of the Solectria Force, except for the following parts:

- Drive Motor
- Automatic Transmission
- Battery
- Solectria-installed wiring

NOTES

1. The diagnostic connector is inoperative on the Solectria, because it is used only with the Geo gasoline-powered vehicle.
2. Replacement rear coil springs must be ordered from Solectria Corp. They are not interchangeable with the standard springs.
3. For safety's sake, always remove the ignition key from the steering column before performing service work on the car.

DRIVE MOTOR

The drive motor is a 3-phase induction motor, located in the rear of the engine compartment behind the battery box, and above the automatic transmission. For the 5-speed version, the drive motor is a brushless dc motor, located in front of the transmission, directly behind the bumper. There are no user serviceable parts on either one of the motors. No lubrication is required for the drive motor.

Adjustment of Drive Belt

A drive belt connects the drive motor pulley to the transmission input shaft. The tension of the drive belt can be checked by applying a 4-1/2 lb force to the mid-point of the length of the drive belt. The belt should deflect about 1/4-inch. If the drive belt tension requires adjustment, loosen the three motor mounting bolts (four on the 5-speed drive motor), and adjust the motor position to obtain the desired belt tension. Retigthen the motor mounting bolts, then recheck belt tension.

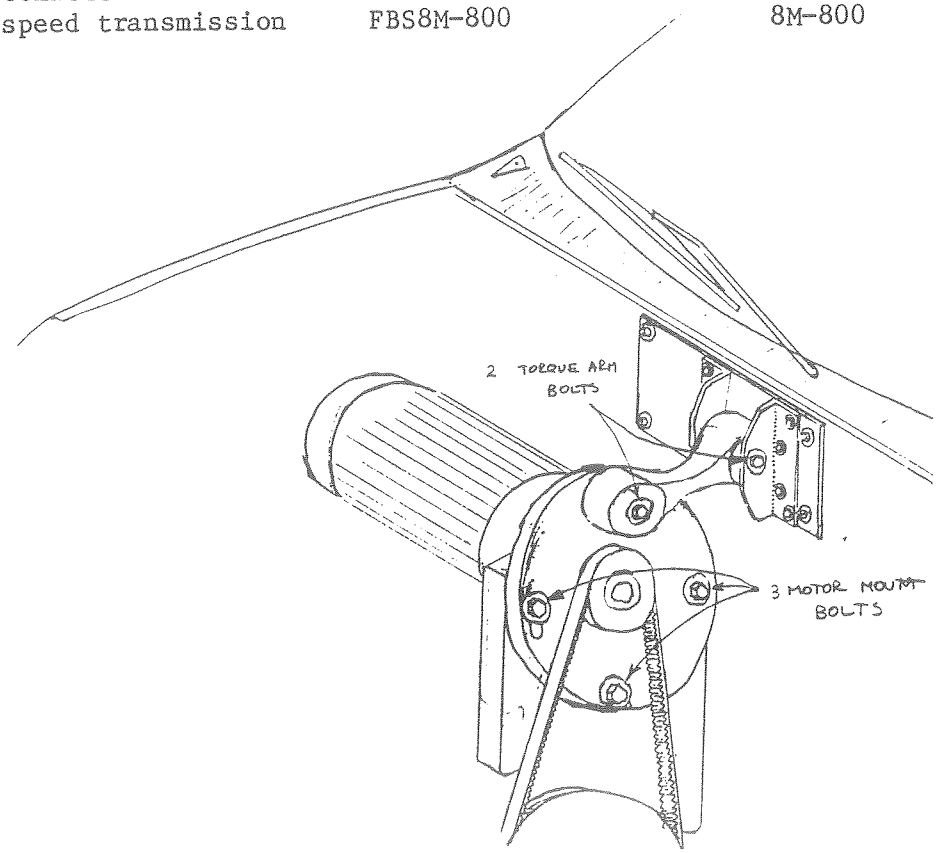
Replacement of Drive Belt

1. Loosen the two torque arm bolts.

2. Loosen the motor mount bolts, then move the motor in the direction to loosen the belt.

3. Remove the defective belt, then install a replacement belt and adjust the belt tension as described in the previous paragraph.

	Solectria Part No.	Gates Part No.
Automatic transmission	FBA8M-720	8M-720
5-speed transmission	FBS8M-800	8M-800



Replacement of Drive Motor

1. Unplug the main power connector, located in the front of the motor for the automatic version, and on the top of the motor for the 5-speed version.

2. Carefully unplug the small diameter logic cable from the controller, which is located in front of the motor (automatic version, or on inner fender on the driver's side for the 5-speed version). The controller is a black box with a heat sink on one side.

3. Remove the torque arm bolts then remove the torque arm.

4. Loosen the motor mount bolts, then remove the drive belt.

5. Remove the motor mount bolts, and lift the motor from the car.

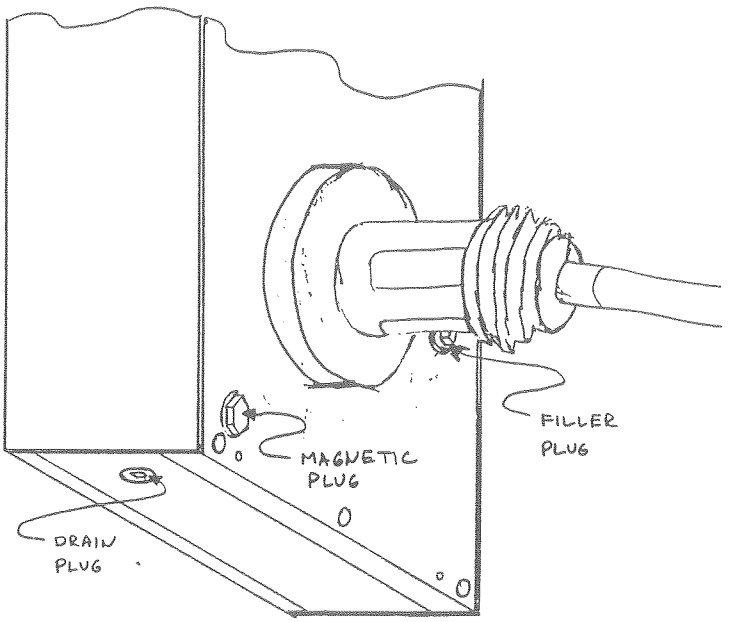
6. To install a replacement motor follow the above procedure in the reverse order.

AUTOMATIC TRANSMISSION

The automatic transmision is a single speed, double reduction drive with an integral differential. The transmission is located underneath the drive motor. The only service procedure is to periodically check the transmission oil level, and change the oil after the first 750 miles, and every two years thereafter.

Checking Transmission Oil Level

Remove the brass filler plug located on the passenger side of the transmission, in front of the drive shaft. The oil level should be at the bottom of the filler plug hole. If necessary, add Mobil 1 5W-30 synthetic motor oil.



AUTOMATIC TRANSMISSION OIL PLUGS

Changing Transmission Oil

After 750 miles of operation and every two years thereafter, replace the transmission oil.

1. Put a drain pan under the transmission, then remove the drain plug located on the bottom of the transmission. After all the oil has drained, remove the 3/4-inch magnetic plug located on the lower side of the transmission (the passenger side). Clean and re-install the magnetic plug.

2. Reinstall the drain plug.

3. Remove filler plug, located on the passenger side of the transmission, adjacent to the drive shaft.

4. Fill with approximately 3 pints of 5W-30 synthetic motor oil.

NOTE

Disregard the instructions in the owners manual regarding use of any other type of oil in the transmission.

5. Reinstall filler plug and check for leaks.

Replacement of Lower Transmission Mounts

Use the following procedure to replace both lower transmission mounts. To simplify the procedure, replace one mount, then replace the other.

1. Raise the front end of car.

2. Loosen both half-inch bolts located in upper torque arm.

NOTE

Perform steps 3 through 9 for one mount, then perform these steps for the other mount.

3. Remove half-inch nut from upper side of rubber mount.

4. Remove two 5/16th inch nuts and bolts from lower side of rubber mount.

5. Raise transmission and motor assembly, and remove rubber transmission mount.

6. Install new rubber mount and loosely install lower bolts.

7. Lower transmission assembly in place.

8. Install upper half-inch nut and torque to 50 ft/lbs.

9. Tighten lower 5/16-inch nuts and bolts to 25 ft/lbs. (Repeat steps 3 through 9 for other mount).

10. Retighten half-inch torque arm bolts to 75 ft/lbs.

11. Lower the car from the raised position.

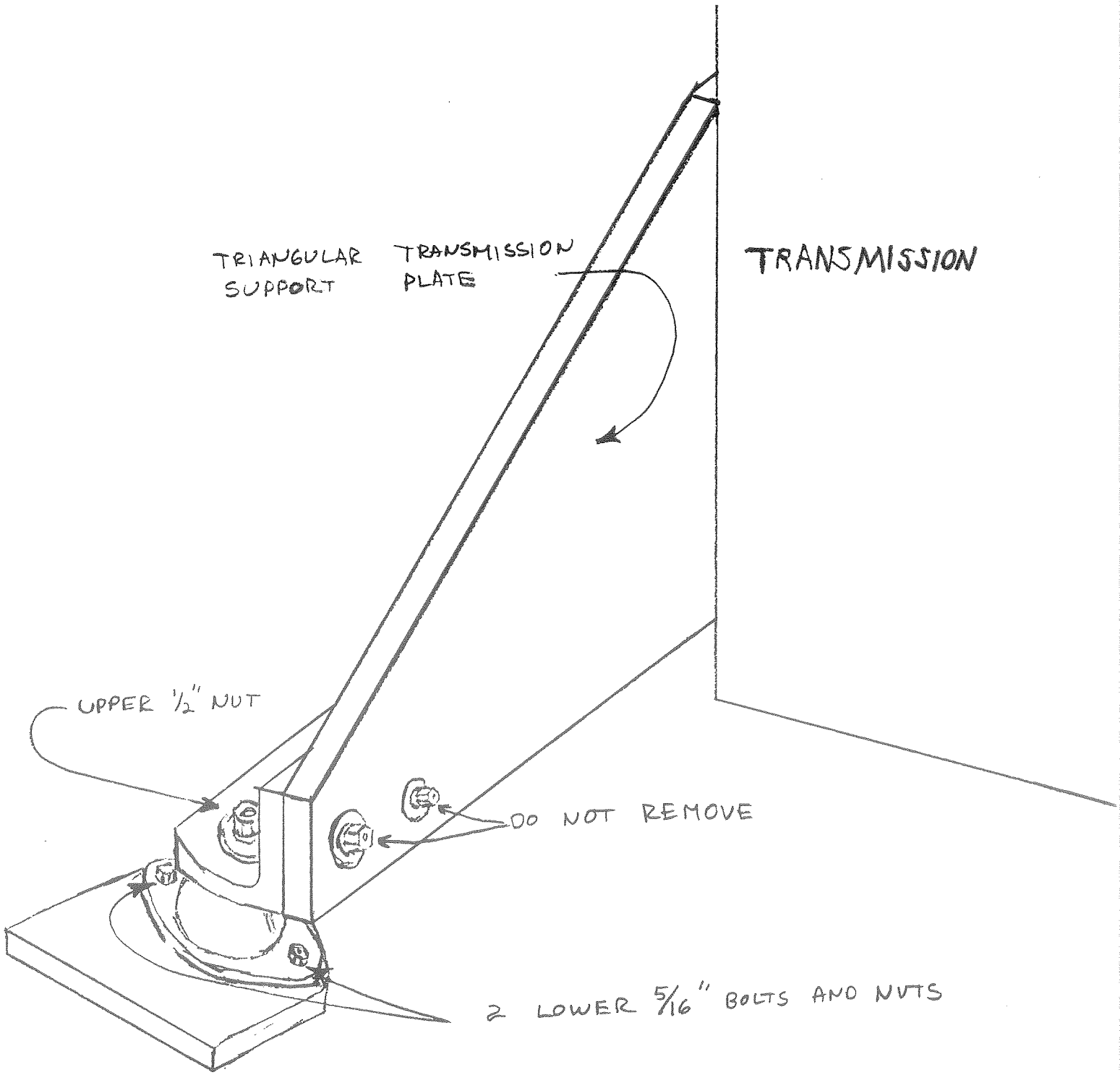

TRIANGULAR SUPPORT
TRANSMISSION PLATE
TRANSMISSION
UPPER ½" NUT
DO NOT REMOVE
2 LOWER 5/16" BOLTS AND NUTS

FIGURE D.

Replacement of the Transmission

1. Remove the drive motor. Refer to the section on drive motor replacement.

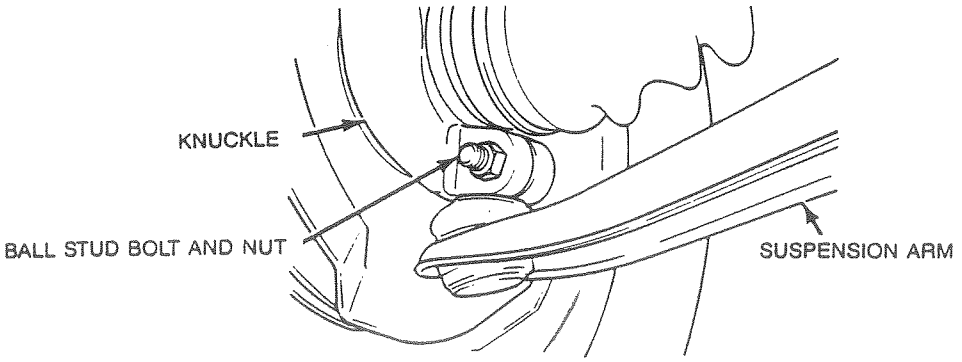
2. Pull up speedometer cable boot at the transmission. Pull out speedomter case clip. Pull speedometer cable from transmission.

3. Remove half-inch nuts from upper side of rubber mounts.

4. Raise car and support on stands so that the front suspension hangs free.

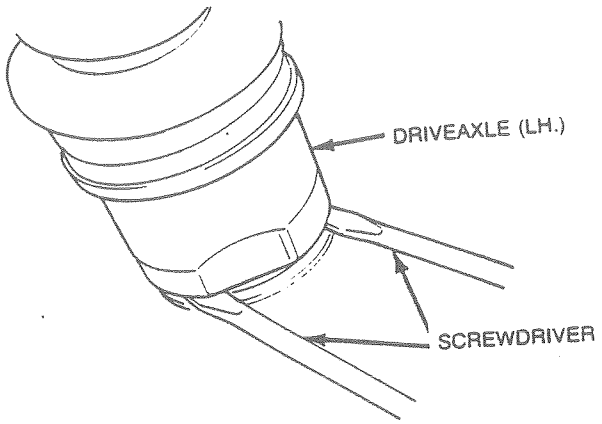
5. Drain transmission oil.

6. Remove ball joint stud bolts as shown.



7. Pull lower ball joints from steering knuckles.

8. Pry drive axle out from transmission using a large screwdriver as shown in page 7B-7 Figure 10, taking care to avoid damaging the seal.



9. Push steering knuckle away from transmission, allowing the drive shaft to hang free.

10. Lift transmisssion off the rubber mount studs, and lower the transmission from the car.

11. Remove triangular transmission support plate from transmission.

12. Install a replacement transmission by following the above procedure in the reverse order.

BATTERY

The battery pack consists of 12 12-volt deep-cycle lead acid batteries. The batteries are located in two boxes. Five batteries are located in the front battery box, and seven batteries in the rear battery box.

Preventive Maintenance

CAUTIONS

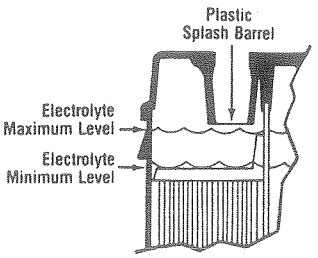
- Battery electrolyte is a sulfuric acid solution. Always wear safety goggles or a face shield and rubber gloves when servicing a battery.

- If battery solution spills on clothing or skin, rinse it off with water immediately to minimize the damage.

- Do not overcharge. The dash-mounted ampere/hour meter records battery usage. For a newly charged battery, the meter will read approximately 0. When the meter reads any more than 5 ampere/hours of battery use, the battery should be recharged. Discontinuue charging when the meter reads -2. Overcharging may occur if charging is allowed to continue so that the meter reading passes the -4 level. Overcharging heats up the battery and causes loss of electrolyte, both of which are detrimental to battery life.

CAUTION

If electrolyte escapes from the battery or battery temperature rises above 125 degree F, stop charging and wait for battery to return to a safe temperature.



Checking Battery Fluid Level

Every 3-months the fluid level in the cells should be checked, and distilled water should be added if necessary. Do not add ordinary tap water to the batteries. Make sure that the battery connections are clean and tight. Procedures for gaining access to the batteries are contained in the following sections.

Fill battery cells to the bottom of the filler well inside each battery cell.

WARNING

Batteries are connected in series, with a total of 144 volts. To avoid shock, use rubber insulating gloves and wear eye protection when handling battery terminals.
Also, a fire or explosion hazard may occur if a wrench or other metal object is placed inside a battery box.

To Gain Access to the Rear Battery Box

1. To gain access to the batteries, remove 1/4-20 socket capscrews from the rear battery box cover.

2. Lift cover from the case.

To Gain Access to the Front Battery Box (automatic transmission

To gain access to the battery box cover, the motor controller must be removed and the air conditioning drive unit must be moved aside. The electrical and hose connections for the air conditioning unit must not be disconnected during for this procedure.

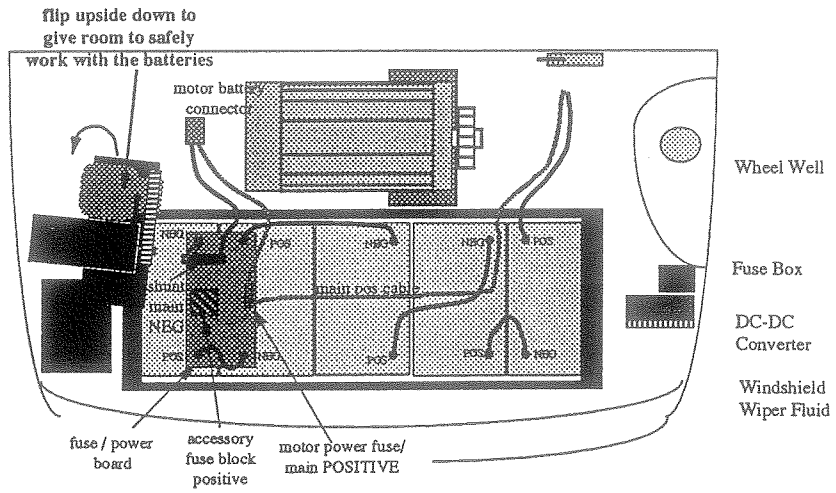


DIAGRAM OF THE INSIDE FRONT BATTERY BOX FOR SOLECTRIA FORCE AUTOMATIC

1. Remove 2 1/4-20 socket cap screws from the air condiioning drive unit mounting plate.

2. Lay the drive unit assembly upside down on the air condirioning controller and inner fender.

3. Disconnect the main battery plug (large gray 2-wire connector) from the motor controller.

4. Disconnect motor connector (large 3-wire connector).

5. Disconnect all of the small connectors very gently.

6. Remove 2 10/32 Allen cap screws that hold the motor controller heat sink to the angle brackets located on either side of the controller.

7. Remove the controller and set it in a safe place. It should not be dropped.

8. Remove the remaining 1-4/20 socket button cap screws from the battery box cover.

9. Remove the battery box cover.

Checking Battery Condition

If the range performance of the car following a full recharge has been reported to be declining, perform the following check. Recharge the battery and drive the car at least 25 miles, or until the car will not maintain 30 mph on a level road. With all lights, fan and heater on, any battery that tests less than 10 volts should be replaced.

Battery Replacement

When replacing a battery, observe the cautions listed in the previous section. See previous sections for the battery cover removal procedures.

WARNING

Before replacing a battery in the front battery box, disconnect and remove one interconnecting cable from the rear battery box.

1. Remove battery cables as required to remove the defective battery.

2. Remove the defective battery. First remove the battery having the handle, then slide the other batteries so that the defective battery can be readily lifted out of the box.

3. Follow the above steps in the reverse order to install a replacement battery.

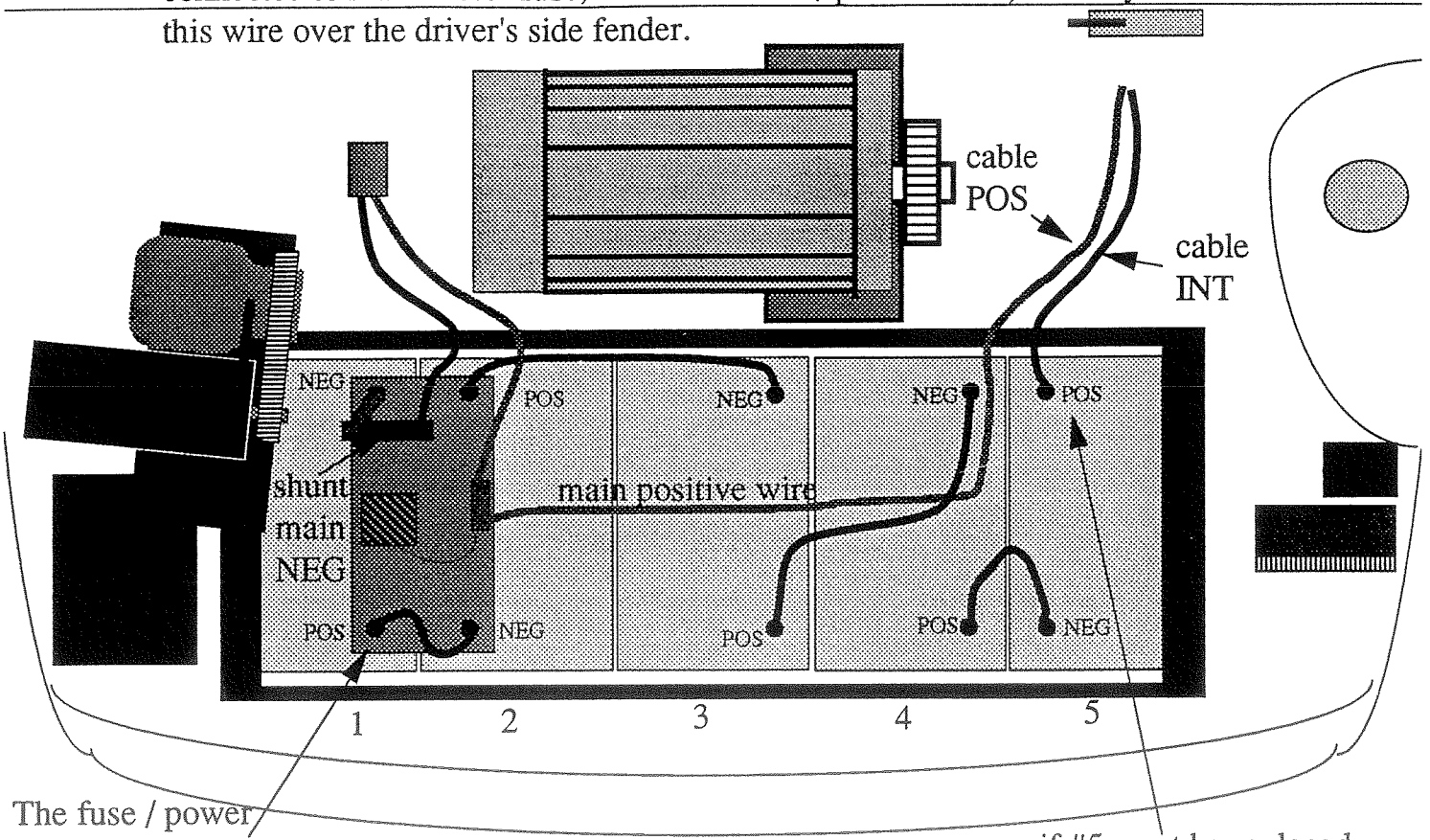
IMPORTANT: FAILURE TO FOLLOW THESE INSTRUCTIONS WILL RESULT IN DAMAGE TO THE NEW BATTERY AND THE BATTERY PACK.

After completing the discharge test mark the bad battery for removal. **Do Not remove battery!** Completely recharge the entire battery pack first, then remove the bad batteries and replace with new fully charged one(s). It is very important to make sure the battery pack is fully charged before removing or installing new batteries. This is to ensure that all batteries are at the same level of charge when they are used.

Please be sure that all service personnel receive this notice.

Battery Removal:

1. disconnect and remove a battery interconnect cable in rear battery pack.
2. disconnect and tape up main positive cable, (marked with white tape, connected to main motor fuse, located on fuse / power board) then lay this wire over the driver's side fender.



The fuse / power board must be removed if either battery #1, or #2 need to be replaced #2 will have to be removed in order to replace #1

CAUTION: If any cable needs to be disconnected in order to remove any battery, it must be completly removed. do not disconnect one end of a cable and leave the other end connected, except in the case of the two cables coming in from the back battery pack (cable "POS", and "INT")

if #5 must be replaced, remove and tape up the cable on the positive term. #4 will have to be removed in order to replace #5.

BATTERY REMOVAL IN FRONT BATTERY BOX OF SOLECTRIA FORCE AUTOMATIC

WARNING: ALWAYS REMOVE A BATTERY INTERCONNECT CABLE FROM REAR BATTERY BOX BEFORE REPLACING A FRONT BATTERY

Battery Box Fan Replacement

A battery box fan is located in the rear battery box only. Use the following procedure to remove and replace the battery box fan.

1. Fold down the car rear seat.

2. Disconnect and remove all battery chargers from the car.

3. Remove the battery box cover, using the steps outlined in a previous section.

CAUTION

In the following step, take care to ensure that you cover the main battery cable terminals with electrical tape to avoid a shock or fire/explosion hazard. Also cover any other wire terminals that connect to the battery box.

3. Disconnect and remove all the battery cables.

4. Remove the rubber mat in the bottom of the battery box.

5. Using a Phillips screwdriver, remove three screws located around the fan hole.

6. Remove 4-5/16th nuts located under the car, beneath the battery box.

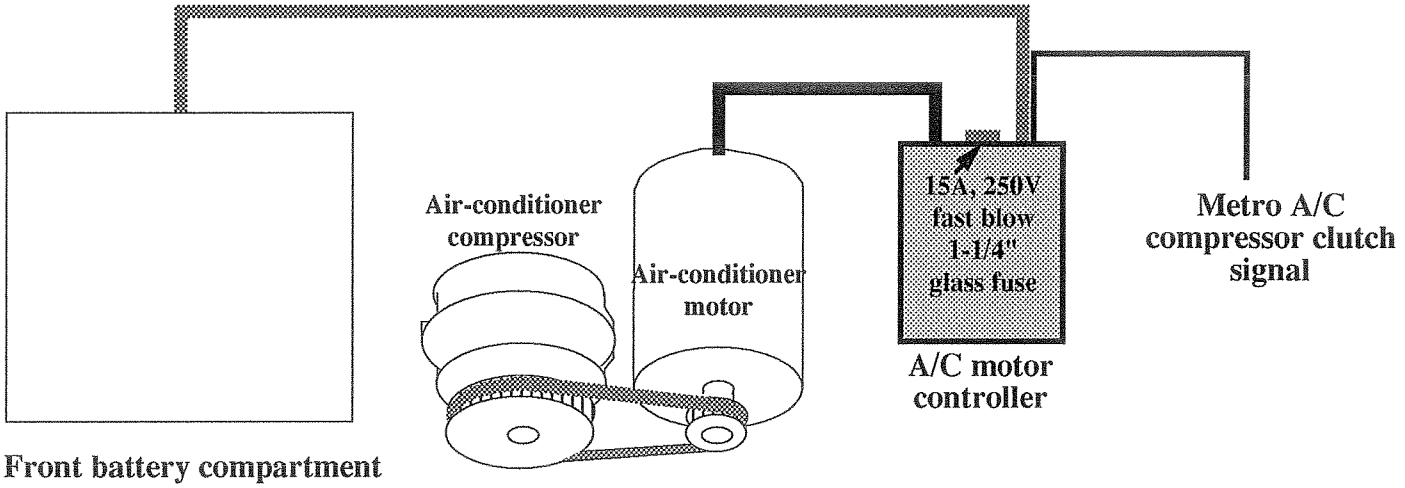
7. Remove 4-5/16th flat-head socket cap screws from left and right sides inside the battery box.

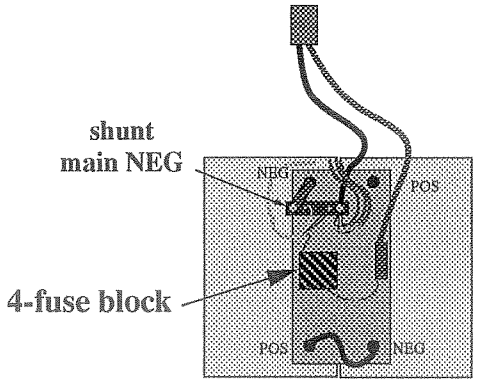
8. Lift battery box and plywood base through the rear hatch.

9. Loosen the fan housing screws and remove the fan from the housing.

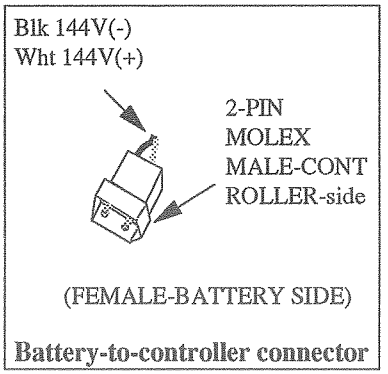
10. Install the replacement fan by following the above steps in the reverse order.

FORCE AIR-CONDITIONING WIRING (1992)

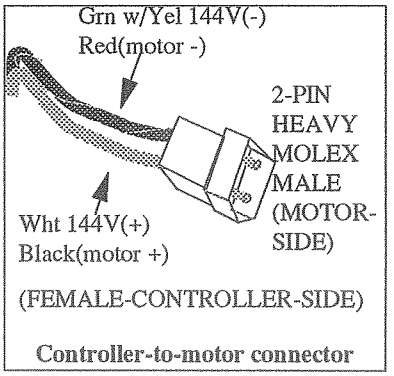




Inside front battery compartment

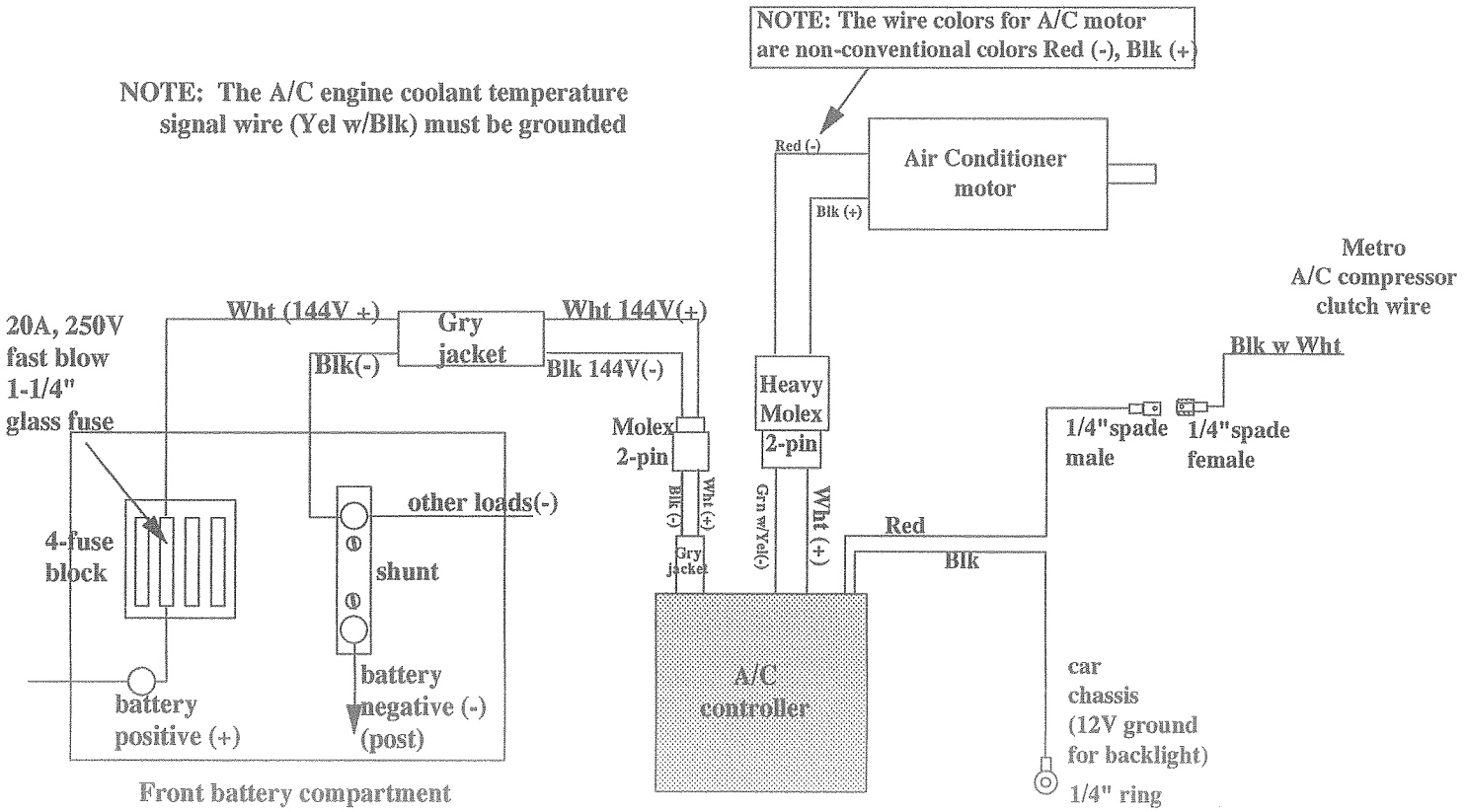


Battery-to-controller connector

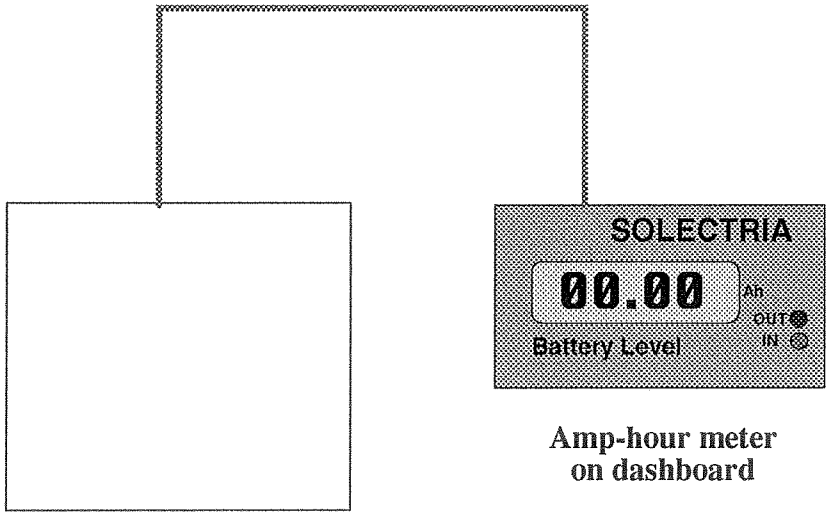


Controller-to-motor connector

NOTE: The A/C engine coolant temperature signal wire (Yel w/Blk) must be grounded

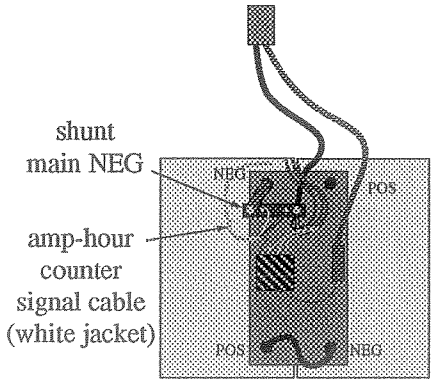


FORCE AMP-HOUR METER WIRING (1992)

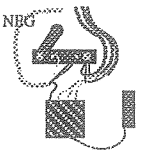


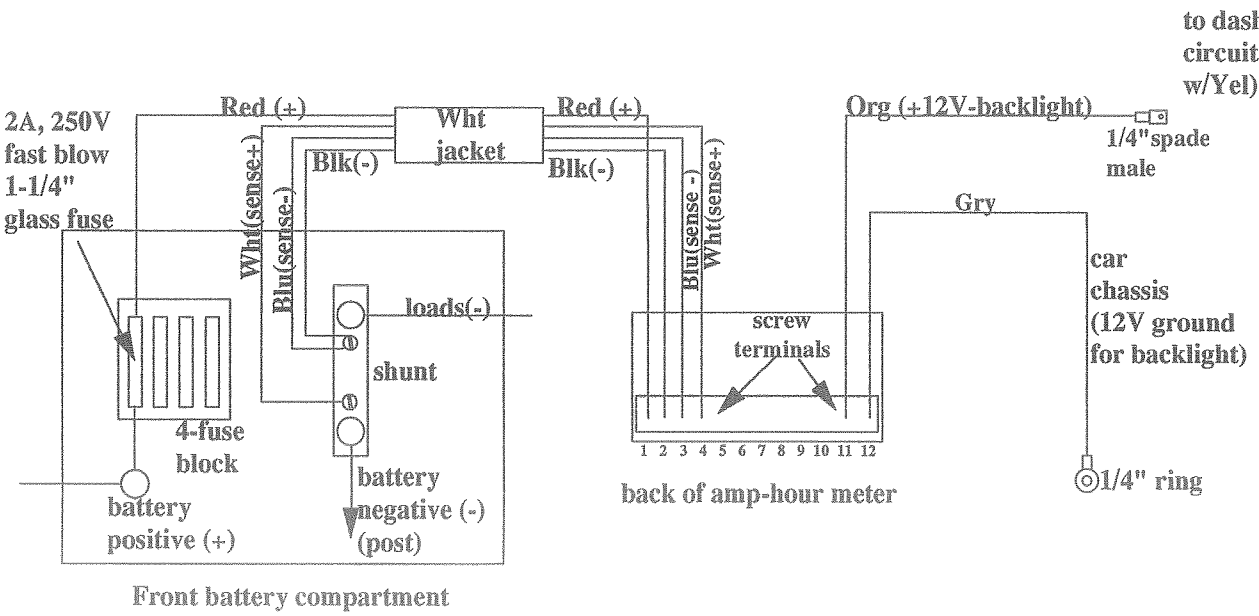
Amp-hour meter
on dashboard

Front battery compatment



Inside front battery compartment





back of amp-hour meter

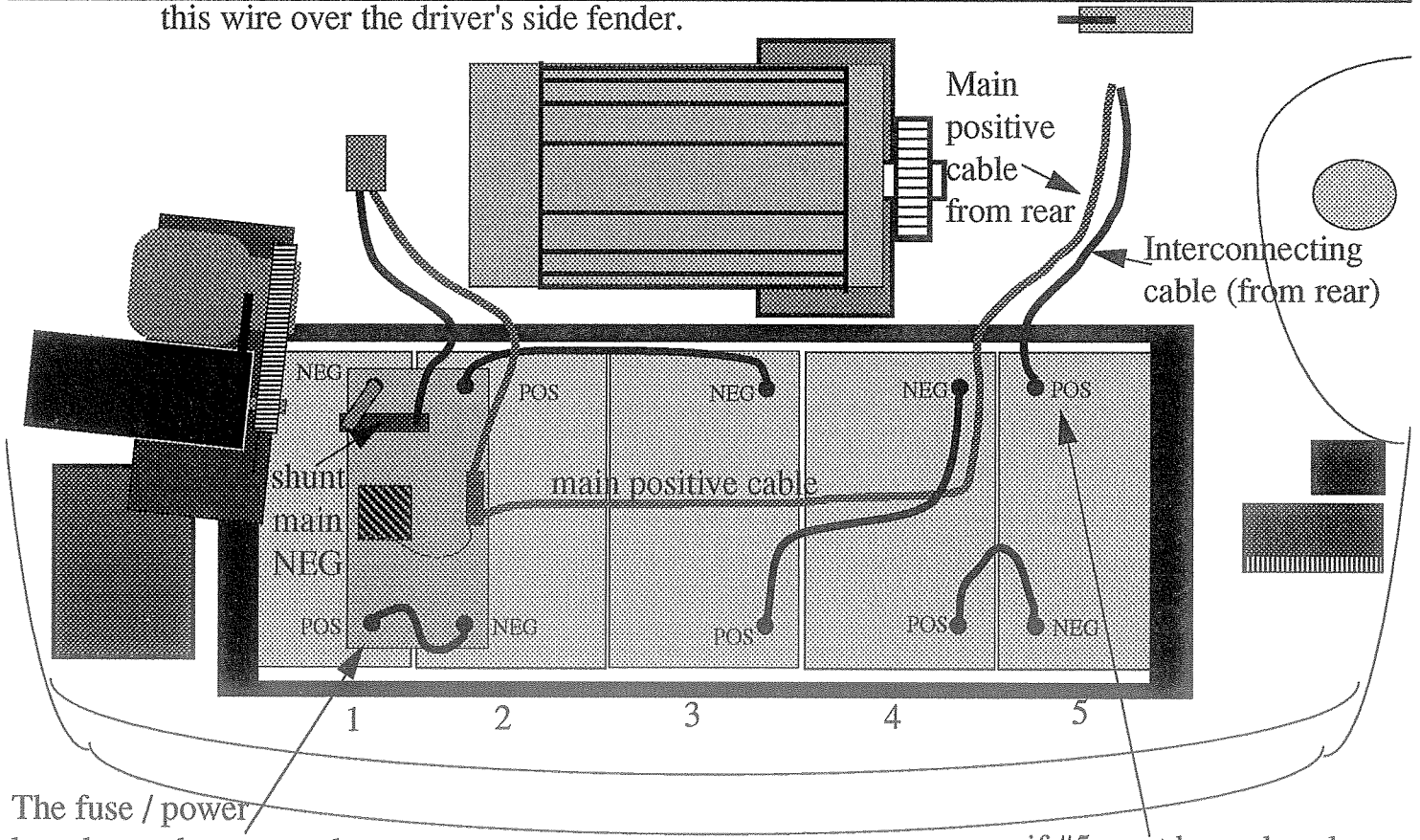
Front battery compartment

BATTERY REMOVAL IN FRONT BATTERY BOX OF SOLECTRIA FORCE AUTOMATIC

Battery Removal:

ALWAYS FULLY RECHARGE BATTERY PACK FIRST (w/on board charger)

1. disconnect and remove a battery interconnect cable in rear battery pack.
2. disconnect and tape up main positive cable, (marked with white tape, connected to main motor fuse, located on fuse / power board) then lay this wire over the driver's side fender.



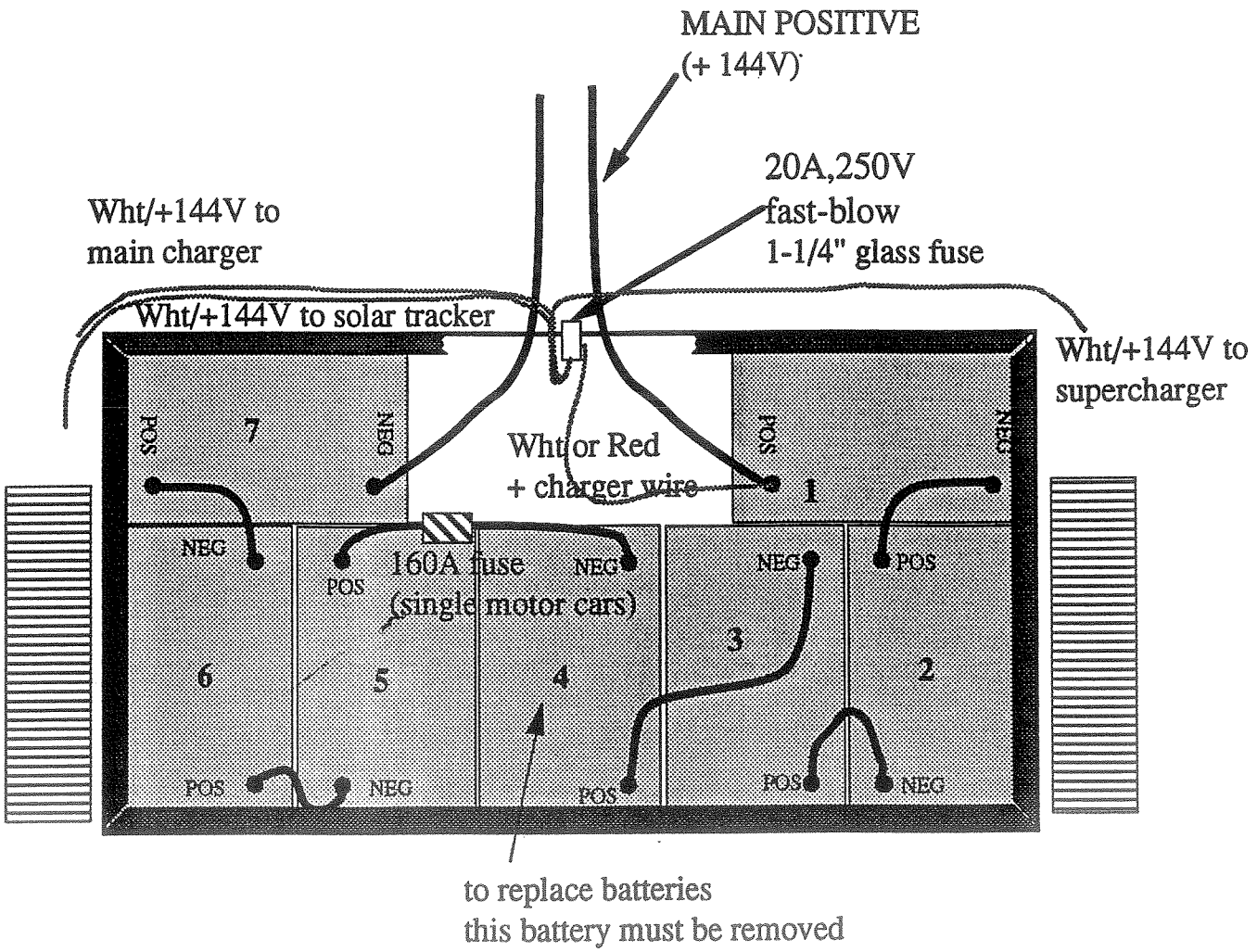
The fuse / power board must be removed if either battery #1, or #2 need to be replaced #2 will have to be removed in order to replace #1

CAUTION: If any cable needs to be disconnected in order to remove any battery, it must be completly removed. do not disconnect one end of a cable and leave the other end connected, except in the case of the two cables coming in from the back battery pack (cable "POS", and "INT")

if #5 must be replaced, remove and tape up the cable on the positive terminal of #5 battery. #4 will have to be removed in order to replace #5.

WARNING: ALWAYS REMOVE A BATTERY INTERCONNECT CABLE FROM REAR BATTERY BOX BEFORE REPLACING A FRONT BATTERY

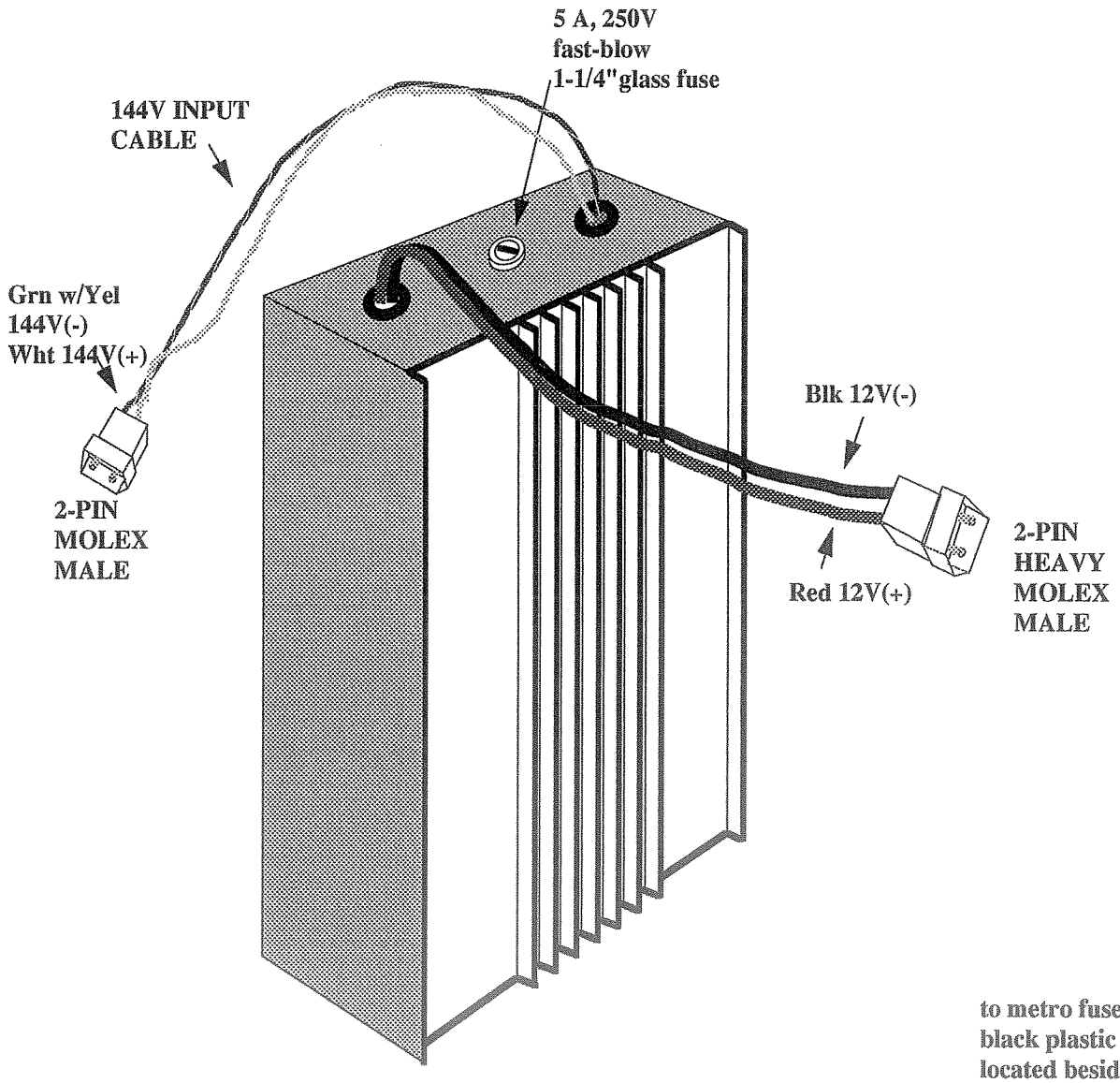
BATTERY REMOVAL IN REAR BATTERY BOX OF SOLECTRIA 4-SEAT LEAD ACID FORCE



Remove wires between #5 and #6 and between #2 and #3 before doing any work.
To replace battery 1 or 2, you must first remove batteries 4&3.
To replace battery 6 or 7, you must first remove batteries 4&5.

BEFORE REMOVING ANY BATTERY, BE SURE TO FULLY RECHARGE THE CAR (WITH ON-BOARD CHARGER). IF BATTERY #1 OR #7 NEEDS TO BE REPLACED, DISCONNECT AND TAPE-INSULATE THE MAIN POSITIVE OR INTERCONNECT CABLE

FORCE DC-DC WIRING (1992)



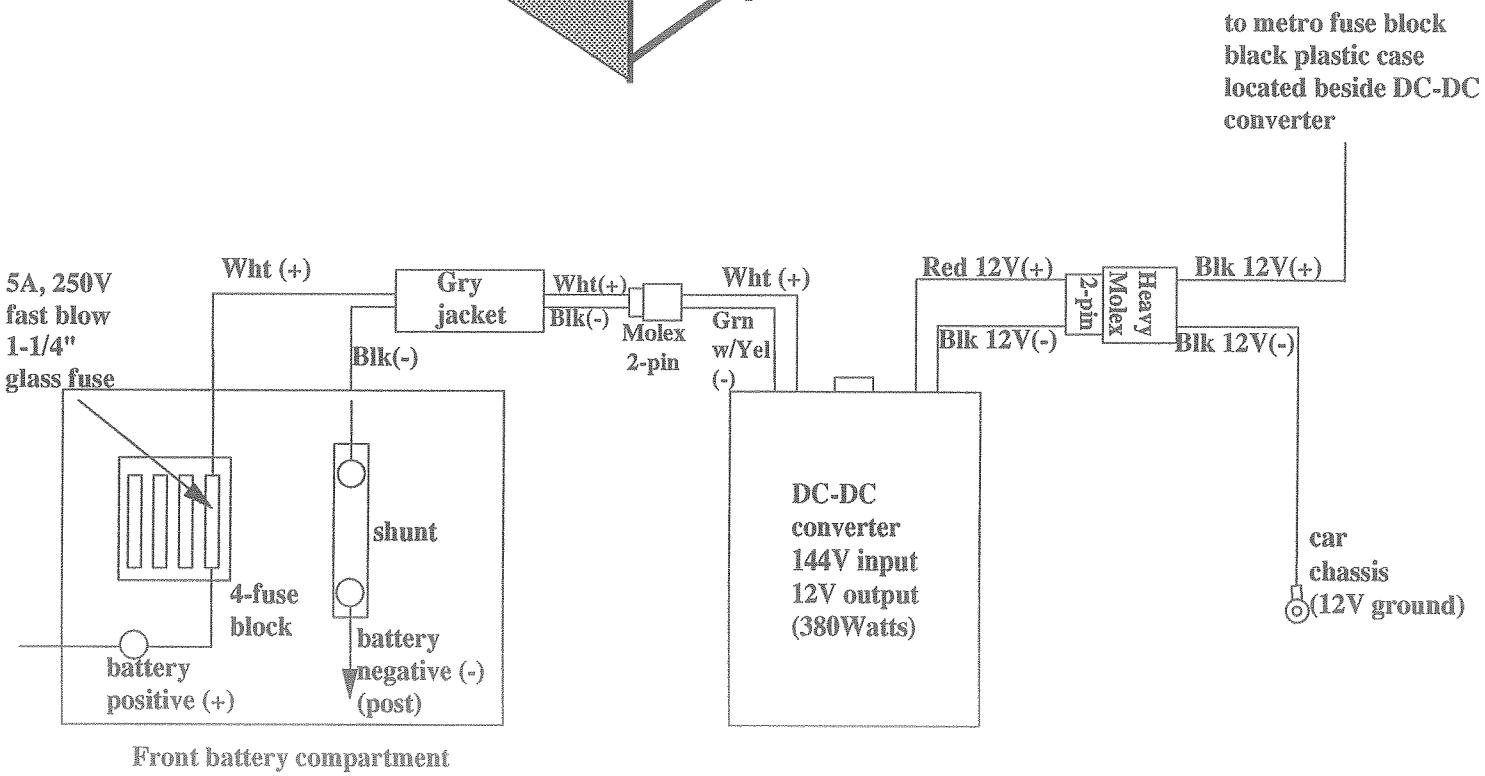
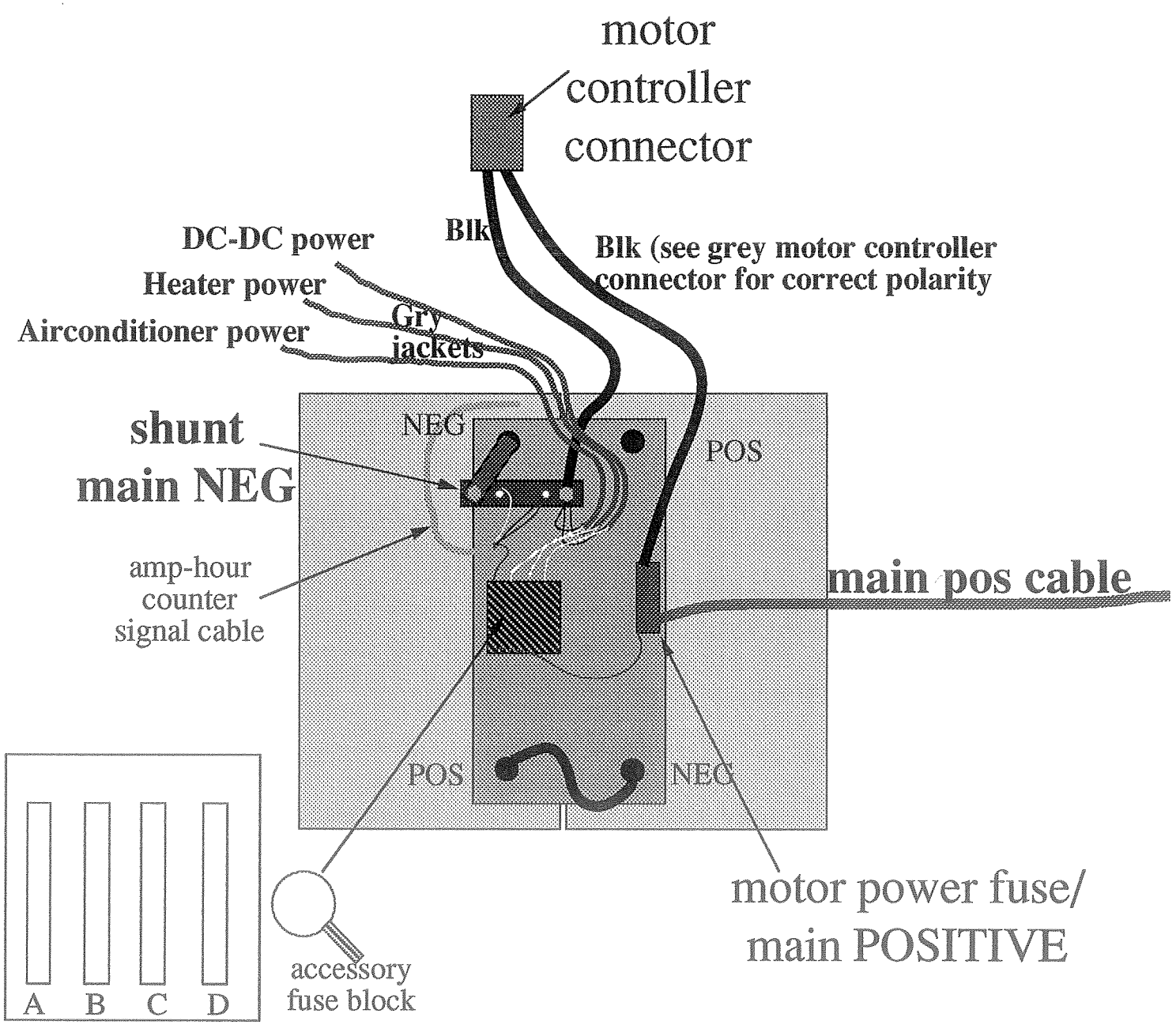
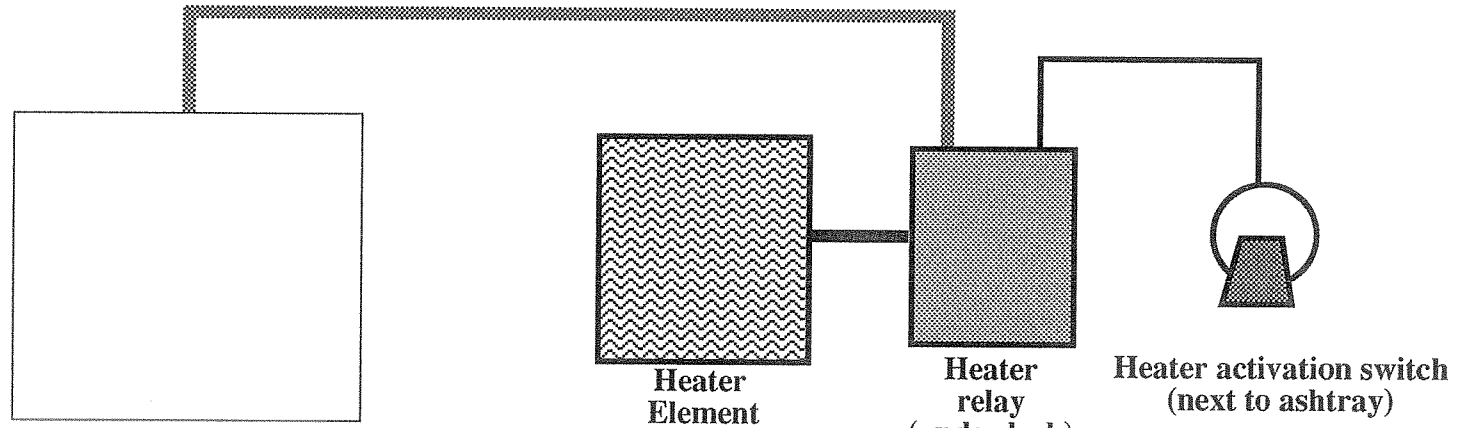


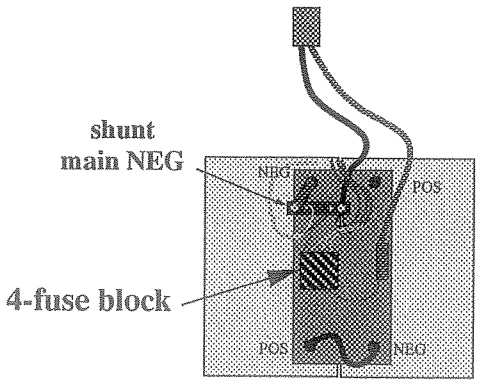
DIAGRAM OF THE FUSE BLOCK INSIDE THE FRONT BATTERY BOX



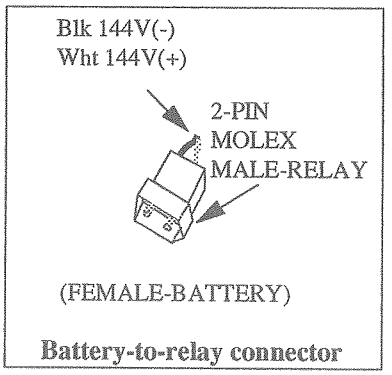
A.) amp hour counter fuse (1A, 250V)
B.) air conditioning fuse (20A, 250V)
C.) heater fuse (20A, 250V)
D.) DC-DC converter fuse (10A, 250V)

FORCE HEATER WIRING (1992)

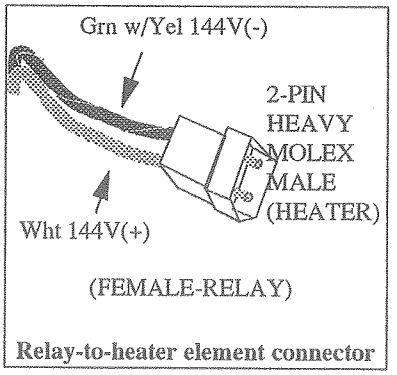




Inside front battery compartment

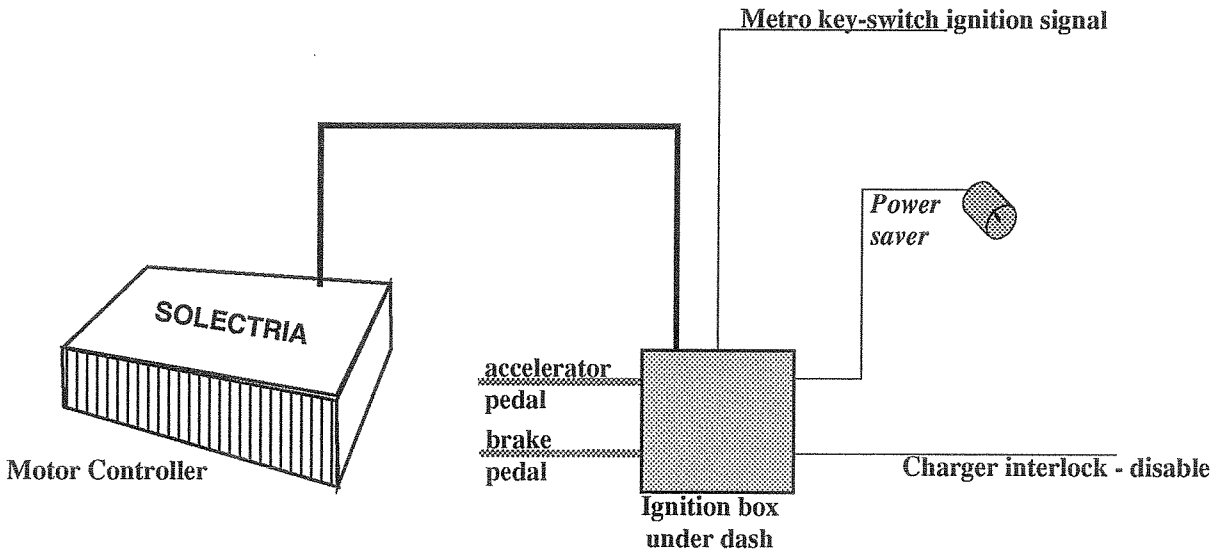


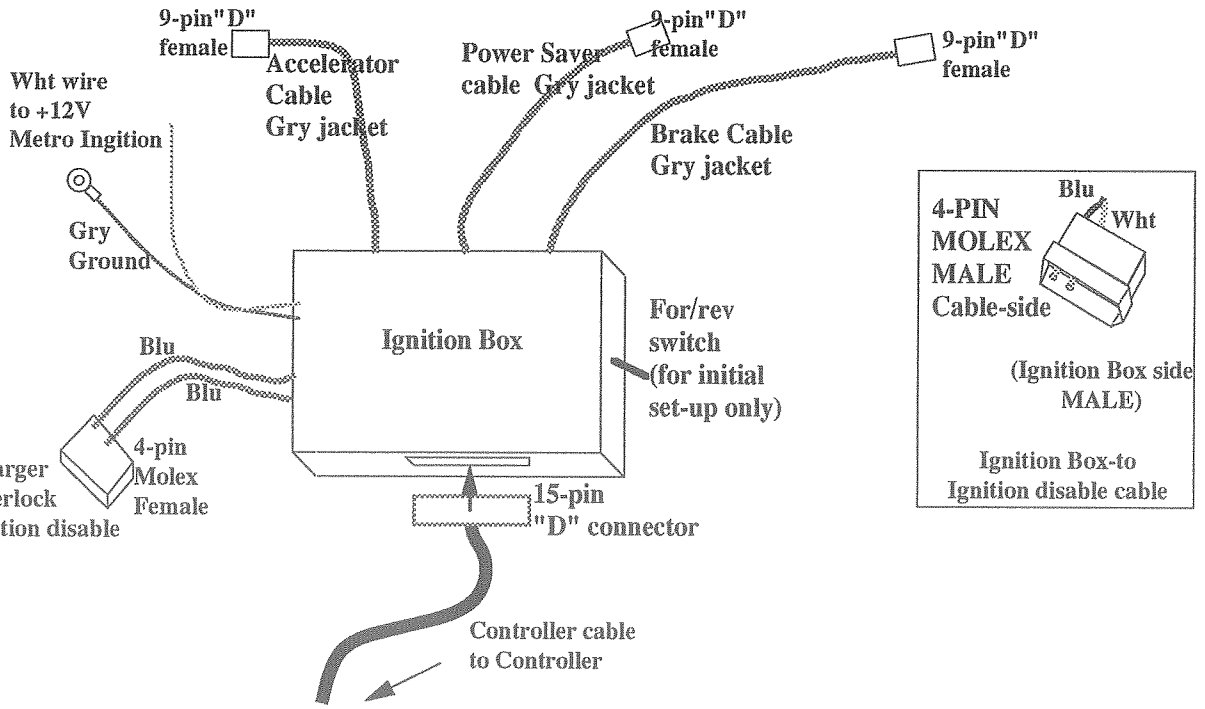
Battery-to-relay connector

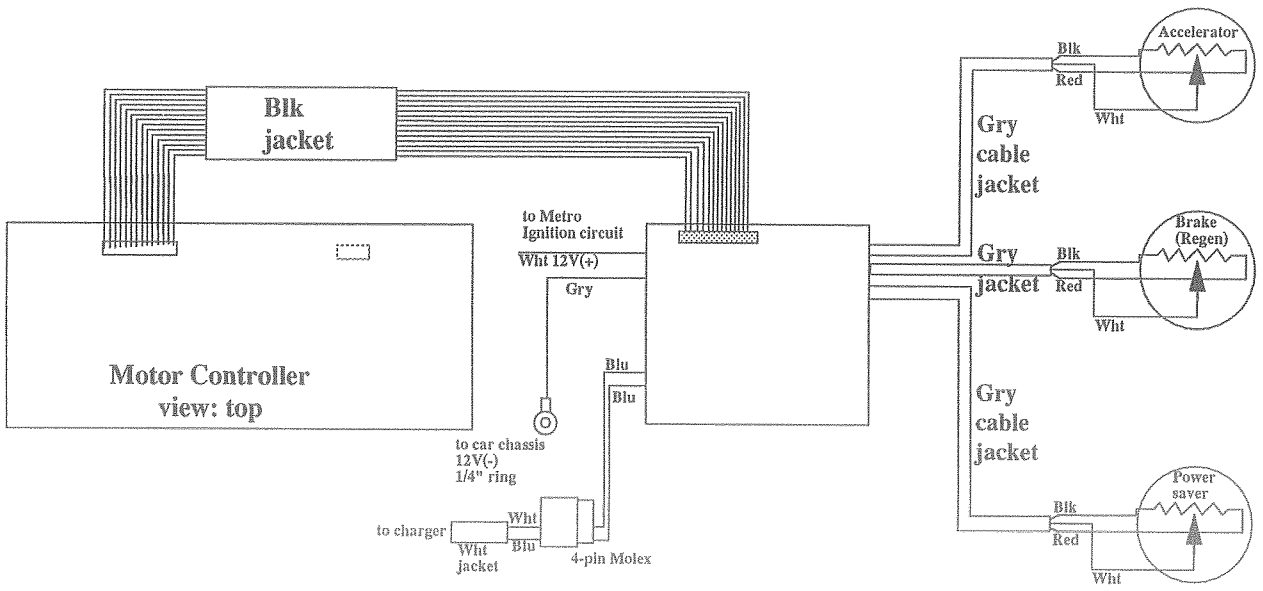


Relay-to-heater element connector

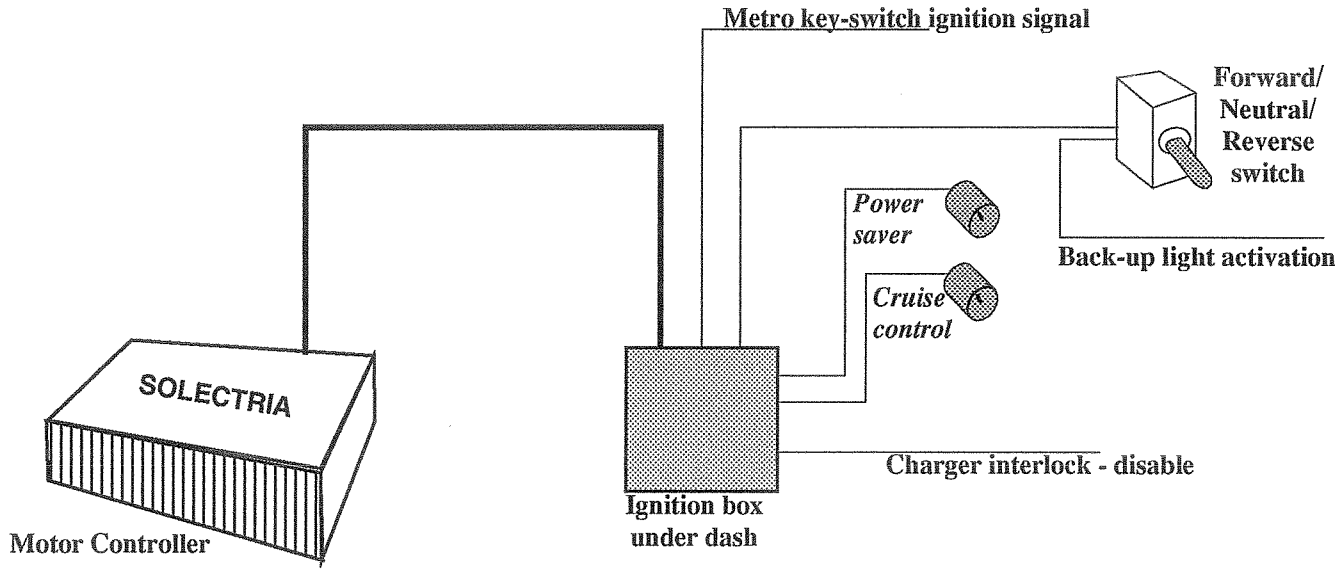
FORCE *5-SPEED* IGNITION WIRING (1992)

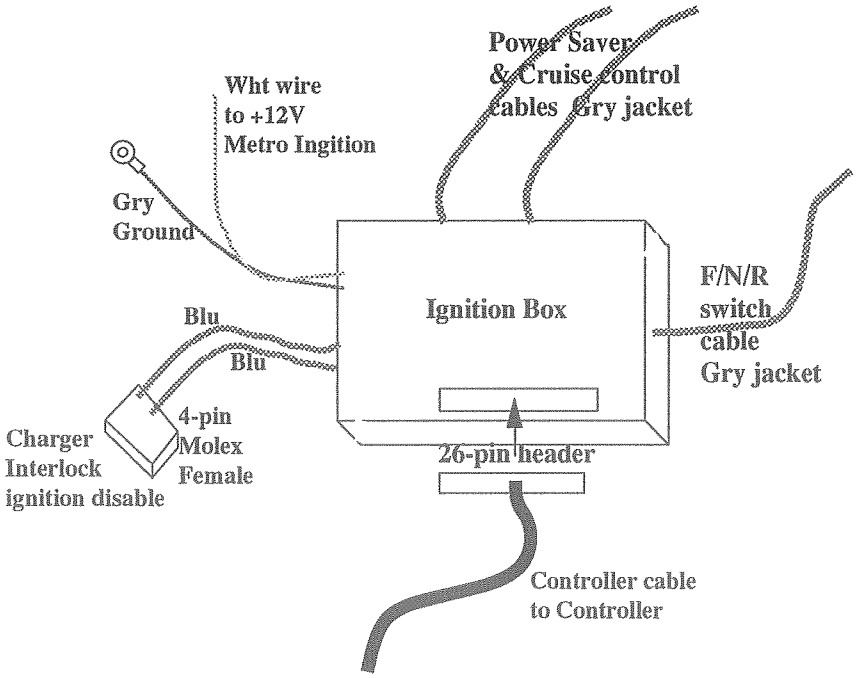


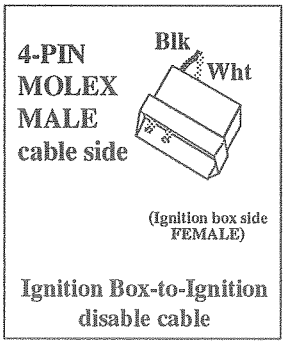


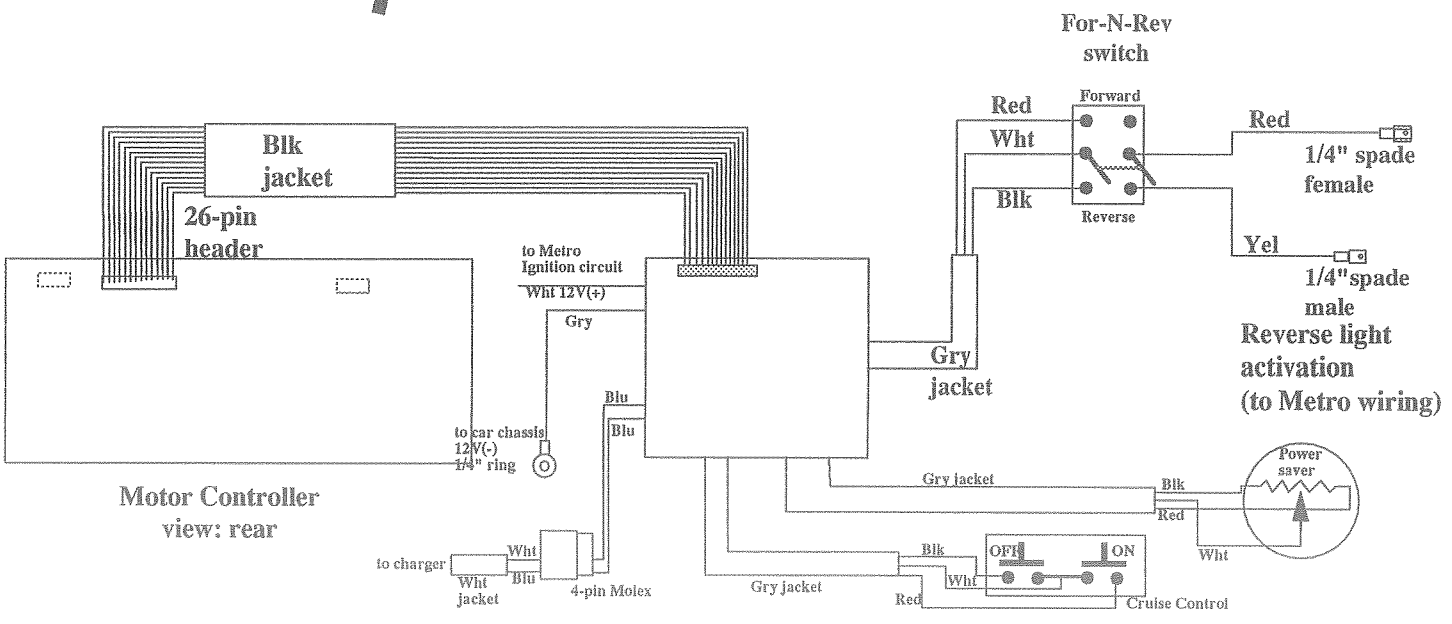


FORCE *AUTOMATIC* IGNITION WIRING (1992)

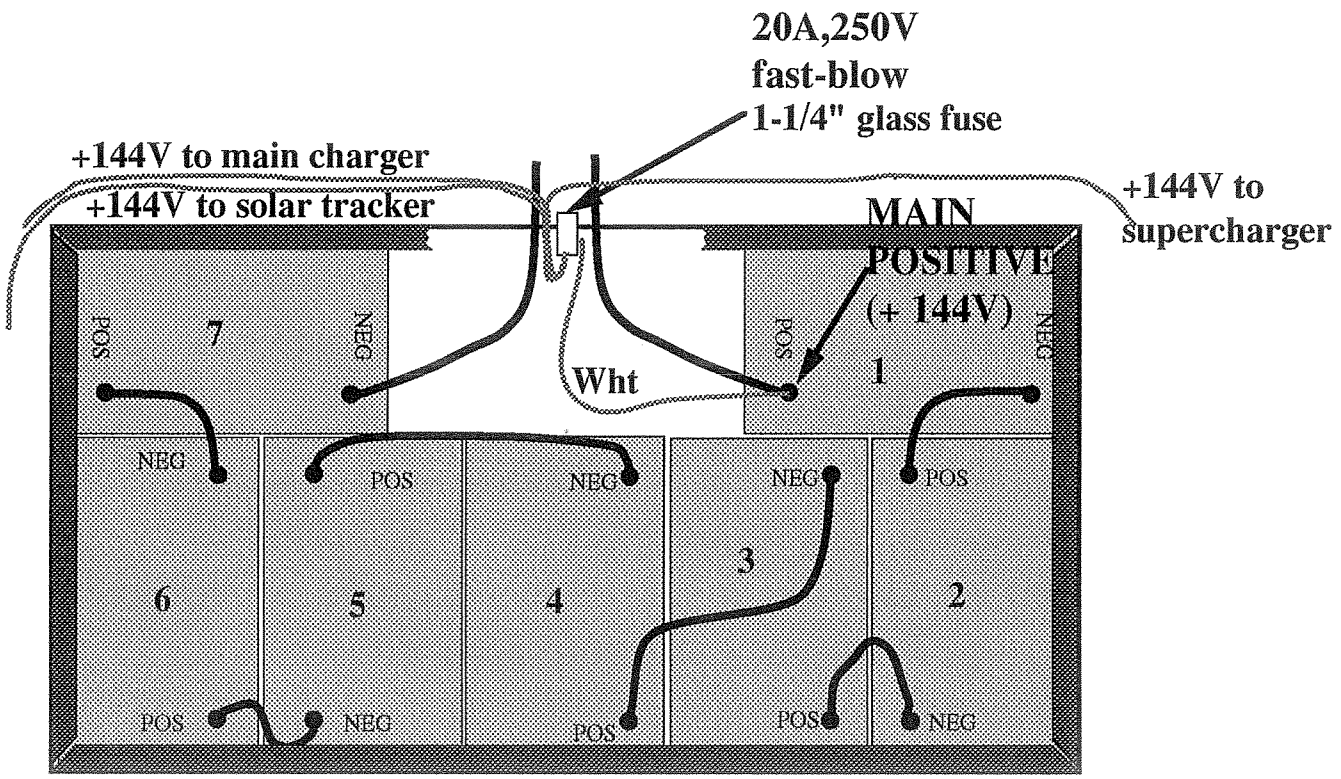


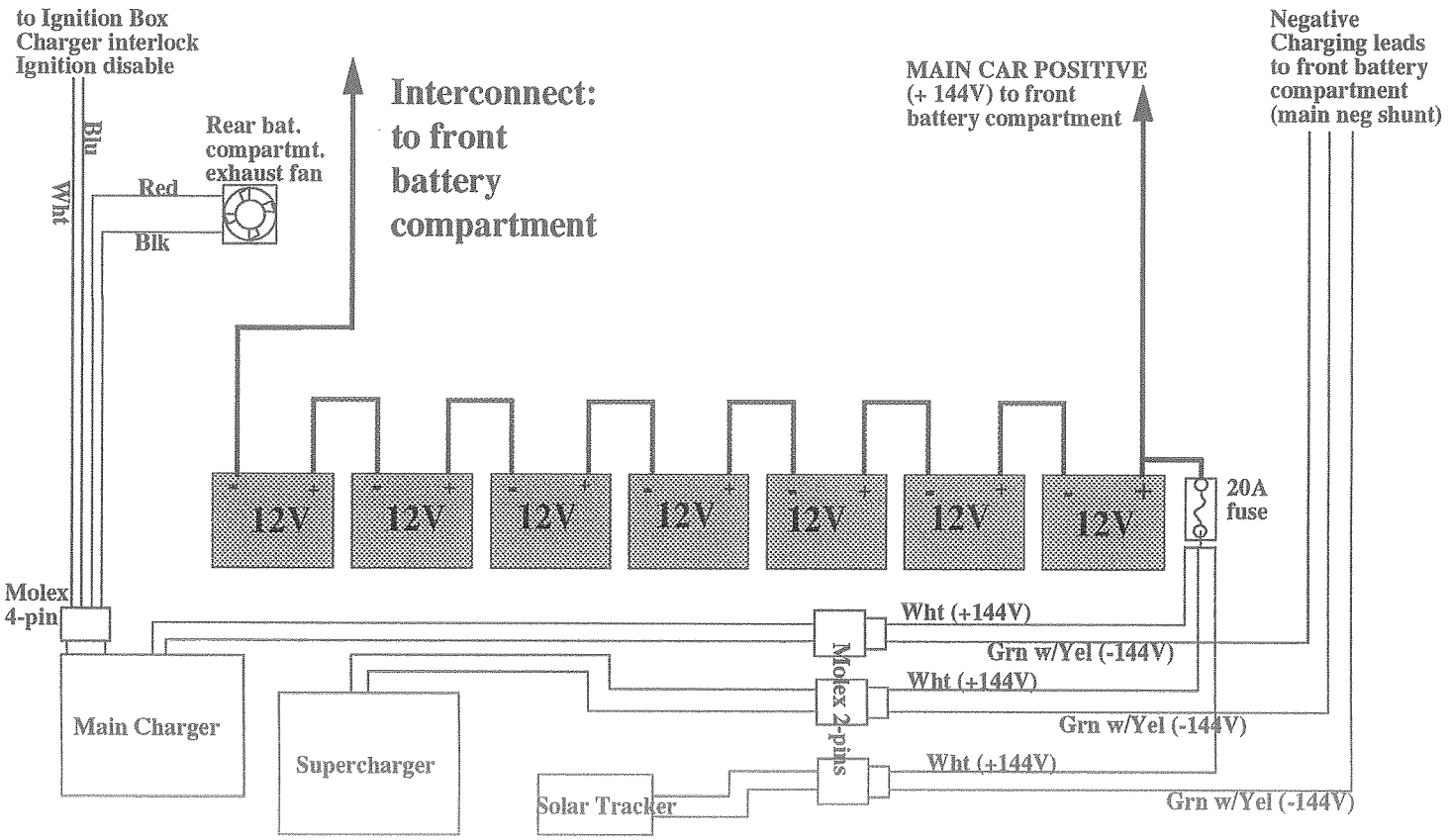




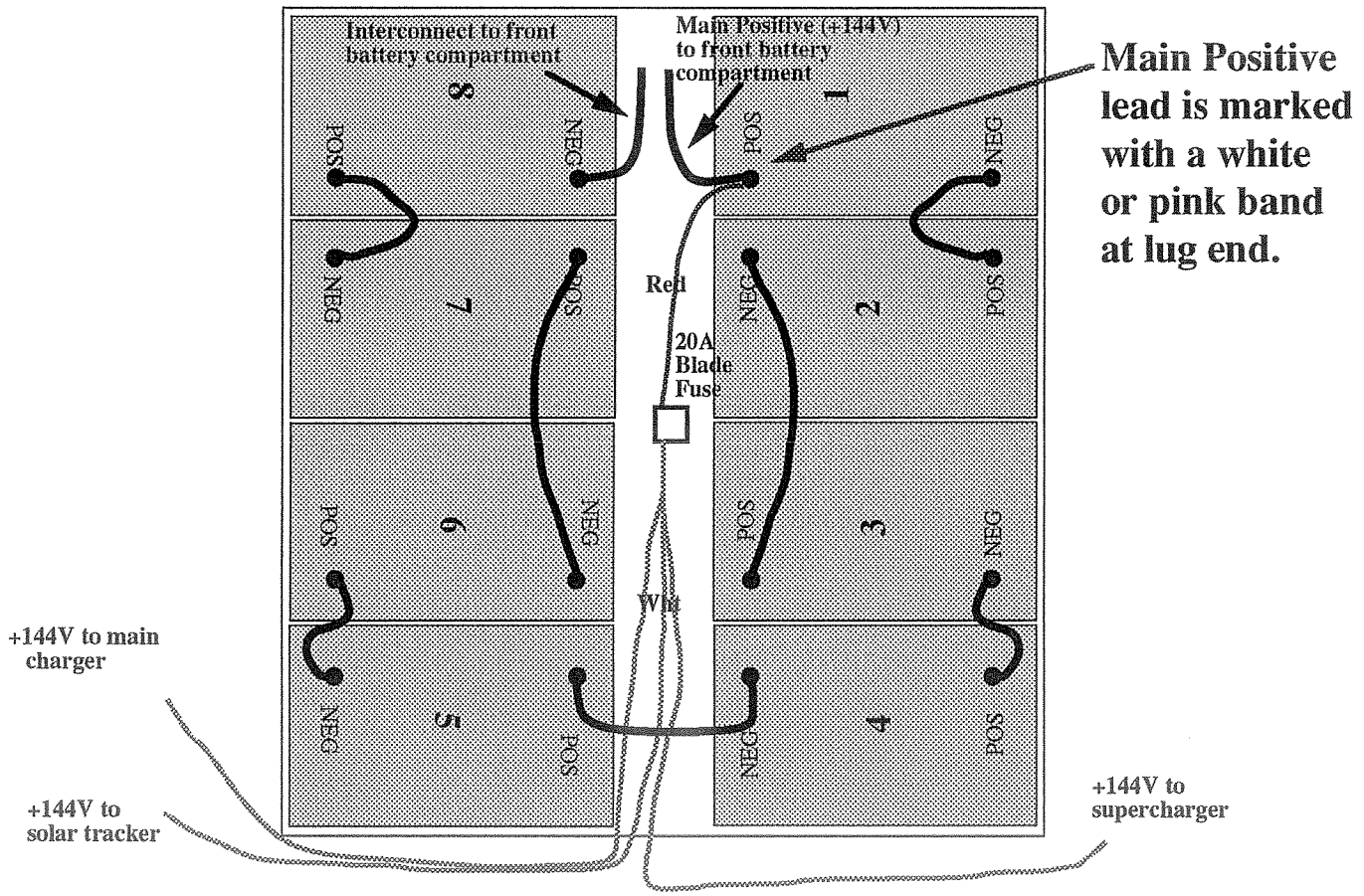


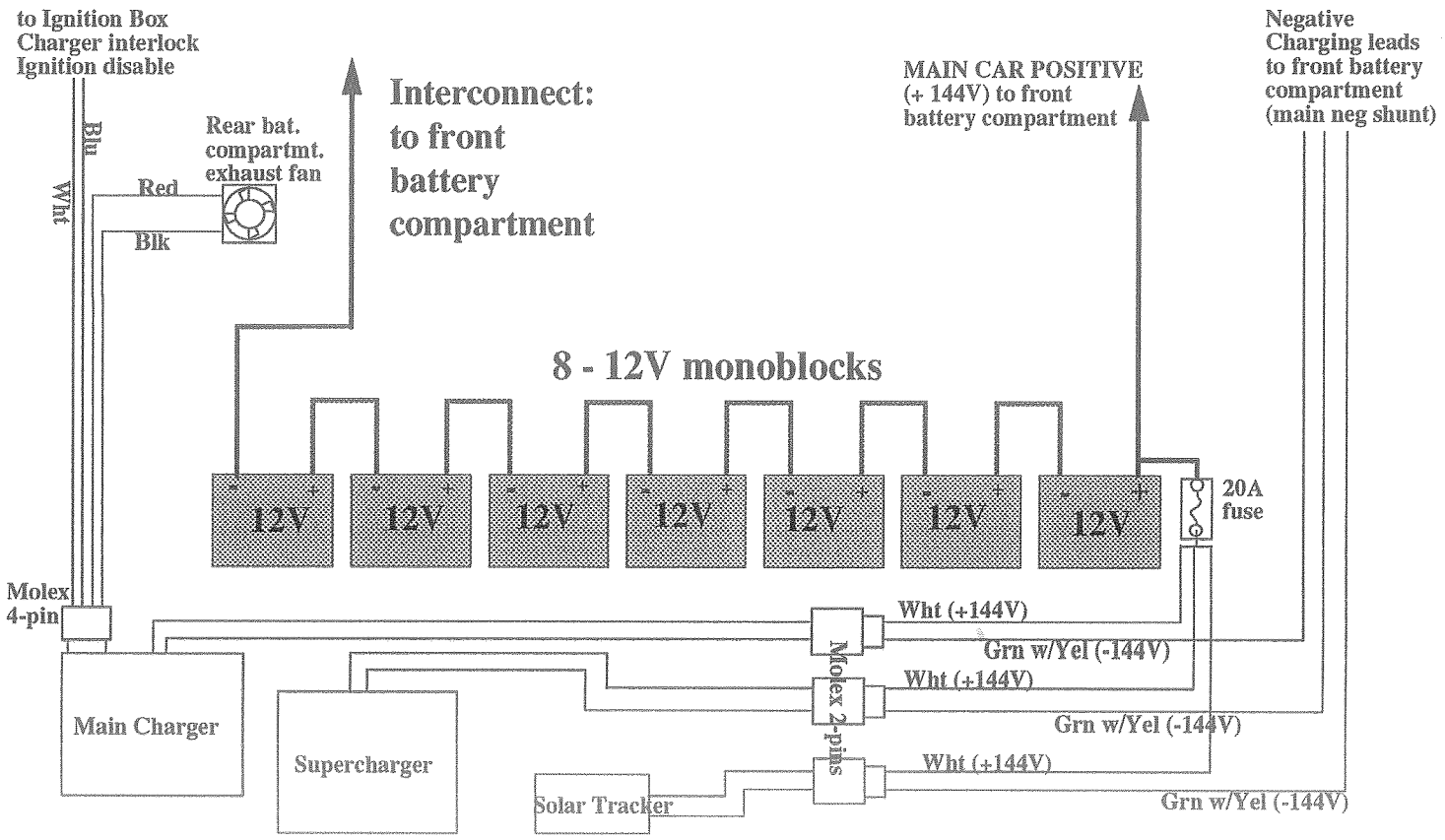
Force Rear Battery Compartment Wiring





Force *Special* Rear Battery Compartment Wiring





FORCE REGEN BRAKE LIGHT WIRING (1992)