OWNER'S MANUAL

1997 SOLECTRIA FORCE

New Jersey Project: Power Commute

First Edition

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Important Safety Information for Emergency Response Personnel and for anyone who is performing technical service or repair to this vehicle.

If this vehicle is involved in a serious accident, a system of internal fuses are designed to protect personnel and prevent damage to vehicle components.

If the vehicle appears to be in a dormant condition, no further action is required to stabilize the vehicle other than turning off the ignition key. Note that when the ignition key is turned off, battery power to the motor controller is shut off. However, the DC-DC Converter, the Battery Charger, the Air Conditioning Controller, and the Amp-Hour meter continue to remain at the full pack voltage.

If the vehicle is giving off smoke and the hood can be opened safely, then perform the following steps:

1. **Undo the red Service Disconnect** located under the hood, near the motor cooling fan on the passenger side of the vehicle (see Diagram in Owner's or Service Manual). This will shut off all high voltage supplied from the battery pack to all vehicle components – except the battery charger.

2. **Undo the separate black Service Disconnect** (in the same vicinity as the red Service Disconnect) to disconnect the battery charger from high voltage.

3. **Undo the main motor controller plug** mounted to the brace bar crossing the center of the motor compartment.

Once these three steps are completed, all vehicle components are now disconnected from the high-voltage battery pack.

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I. INTRODUCTION

Congratulations on your purchase of a new electric drive Solectria Force automobile. Solectria Corporation prides itself in building the most efficient, practical electric vehicles available.

The car you have purchased uses a new Geo Metro body, along with advanced Solectria electric drive components. The Force offers clean, energy-efficient transportation along with durability and convenience. Solectria Corporation is confident that the high quality workmanship and components in your new Force will provide you with years of trouble-free transportation and the satisfaction that comes from driving a zero emission vehicle.

Solectria has provided some of the key information from this manual on the inside of the sun visor on the driver's side of the vehicle. Please refer to this manual for more detailed information and explanations.

Please read this manual carefully in order to ensure proper operation and maintenance of your vehicle. Although this car looks similar to a gasoline-powered vehicle and is simple to drive and maintain, the Force does require care and some preventive maintenance. Reading this manual is essential for the safe, long-lasting, and trouble-free operation of your vehicle.

How to Use this Manual

This Owner's Manual is divided into ten sections. Section II covers the Safety Features of the Force, Section III covers operation of the vehicle, including driving the vehicle, recharging the vehicle, using the regenerative braking, and parking. Section IV covers the drive components installed by Solectria, including the motor, motor controller, batteries, and other electronic equipment used to monitor or regulate electric energy consumption of the car. Section V provides suggestions on efficient driving. Section VI has information on reporting safety defects. Section VII contains a detailed maintenance schedule to ensure that the vehicle is kept in peak operating condition. Section VIII contains warranty information and instructions on seeking repair of the vehicle if you should need it. Section IX is a troubleshooting guide for when you have problems and for minor repairs and adjustments. Section X contains diagrams of the vehicle motor compartment and a layout of major vehicle components.

We welcome your comments and suggestions for improving the Force and/or this Owner's Manual. Give us a call or send us a note on how we can make this manual better serve your needs.

II. SAFETY FEATURES

The Force has been designed to maximize performance while maintaining a high level of safety. The Force incorporates many safety features both in terms of helping to avoid or avert accidents as well as protecting the passengers in the event an accident does occur.

The Force is heavier than the original Geo Metro from which it has been converted, due to the substantial weight of the propulsion battery. Solectria has deliberately and carefully located the battery boxes as low as possible on the car frame (without affecting the vehicle ground clearance), for improved stability and handling of the car. In addition, the batteries have been placed in the vehicle so as to evenly distribute the weight of the vehicle on each wheel. The low center of gravity of the battery and the vehicle and the even weight distribution also improve the braking performance and the stability of the vehicle during hard braking or in an accident, making it less likely to roll or pitch forward.

The Force is equipped with vacuum-assisted power front disc brakes, front regenerative braking, and rear power brakes, for efficient and effective braking under all road conditions. Immediately upon releasing the accelerator pedal, the motor controller applies the full regenerative braking power to the front wheels, slowing the vehicle even before the hydraulic brakes are applied. For more rapid braking, the hydraulic brakes can be applied by stepping on the brake pedal, giving the maximum braking power.

The regenerative braking function can be switched off to prevent sliding under extremely slippery conditions. For more information about the regenerative braking feature, see the Regenerative Braking in SECTION III, VEHICLE OPERATION.

The battery boxes in your Force are constructed of high-strength aluminum and are secured to the vehicle frame outside of the passenger compartment area, using high-strength fasteners.

The battery is made up of sealed, starved-electrolyte battery modules which require no maintenance over the life of the battery. Because the modules are sealed, no appreciable amount of dangerous fumes or gases are emitted from the battery.

The battery boxes are passively vented to allow the release of gases that build up in the battery boxes in the unlikely event that a module seal is broken (such as in an accident). Both battery boxes have high-current in-

line fuses to disconnect the battery in the event of an electrical short, an accident, or other abnormality.

The Force is equipped with a driver-side and passenger-side air bag, or supplemental restraint system. This system is provided by Geo and is intended as a *supplemental* restraint system. Solectria strongly urges you and your passengers to always wear seat belts when driving or riding in the vehicle. Please familiarize yourself with the information provided by Geo in its Metro Owner's Manual regarding the operation, use and maintenance of the airbag system.

III. VEHICLE OPERATION

The Solectria Force has been built to provide you with trouble-free driving. The Force drives and handles much like a conventional gasoline-powered vehicle. Certain aspects of the car, however, will seem different to the new electric vehicle owner. This section covers the day-to-day operational features of the vehicle which may be different from what you are used to with a conventional car.

Vehicle Layout
While most items in the Force are similar to those in a Geo Metro, there are a few items that are different.

Range-Power Selector
The Range-Power Selector located on the console assembly between the front seats is used to select the driving mode for the Force. **ALWAYS** put the vehicle in **OFF** when leaving the vehicle. There are three selections for forward driving, labeled **ECON**, **NORMAL** and **POWER**, and one setting (**REV**) for reverse. These positions correspond to maximum current (i.e. power) available for the motors. For maximum efficiency and range, always drive in the **ECON** mode. **NORMAL** and **POWER** will provide higher levels of power for hard acceleration, but can substantially increase the load on the battery, decreasing range and reducing battery life.

Neutral Interlock
Always start the vehicle with the selector set to the **OFF** position. If the vehicle is started with the selector in **REV** or one of the three forward settings, the vehicle will not operate until the selector has first been switched to the **OFF** setting This safety feature is designed to help prevent unintentional operation of the vehicle.

Amp-Hour Meter
The Amp-Hour meter, located in the instrument panel next to the speedometer, provides a highly accurate measure of electrical energy use in your electric vehicle.

- As you draw energy from the battery, the meter counts up and the red **OUT** LED flashes, indicating energy consumption.
- As you put energy back in to your car (during charging and regenerative braking), the meter counts down and the green **IN** LED flashes, indicating energy storage.

The rate at which the lights blink corresponds to the amount of current

going into or out of the battery pack. For the first few miles of driving with a fully charged battery, the regenerative braking effect will be reduced.

Ammeter (Optional)
This meter indicates the electrical current going out of (or into) your battery. During rapid acceleration, you may draw as much as 300 amps. During regenerative braking, the ammeter may go as low as -100 amps. The Force motor controllers which regulate the energy from the battery will limit the current (i.e. power) available from the battery at low states of charge (SOC roughly less than 20%) in order to protect the battery from harmful over-discharge.

Voltmeter (Optional)
The voltmeter measures the voltage of your battery pack. It is normal for the voltmeter to fluctuate up and down as you change the demand for energy from the battery. An increase in current demand, for example when climbing a hill, will result in a decrease in battery terminal voltage. The motor controllers will prevent the battery terminal voltage from dropping below a minimum value by limiting current (power) output, as the battery reaches the fully discharged state. With no significant electrical load on the battery, the voltmeter can be used to provide a rough idea of the state of charge of your batteries.

Dual Ammeter/Voltmeter (Optional)
This option provides both an ammeter and a voltmeter in a single, dash-mounted gauge. Please read the descriptions above for each separate meter to familiarize yourself with its operation.

See Section V - Efficient Driving.

Battery Charging
One of the nicest benefits of being an electric vehicle owner is never again needing to pull into a gasoline station to fill up your tank. Since the Force uses electricity stored in its battery as its source of energy, the vehicle must instead be recharged via the recharging plug (located under the 'gas' cap) and extension cord.

Charging the vehicle is designed to be very simple. Your Force is equipped with an onboard electronic charger. The Force charger may require 120 V or may require 208/240 V AC current depending on the charger option selected. To charge your vehicle, simply plug a heavy–duty (10 gauge or 12 gauge) grounded extension cord, such as the one provided with your vehicle, into the charge port located on the driver's side of the car inside the gas cap door, and plug the other end into an appropriate electrical outlet rated for 20 amps.

WARNING!

Make sure that you plug into the appropriate outlet when charging. Your car's charger may require 110 V AC or may require 220 V AC - check the label on your car's plug (found under the former gasoline fill-cap). Plugging-in to the wrong outlet could seriously damage your charger. (Note: If no 220V AC is available, a Solectria 220 V charger may be plugged into a 110 V outlet by using the 1-foot adapter cord provided with the vehicle.)

Use only heavy gauge extension cords (minimum 12 gauge) rated for the correct voltage and current (20 amps) with a grounding prong to prevent overheating of the extension cord and electrical shock. Do not remove the grounding prong from the extension cord or use an ungrounded outlet.

The outlet used must be on a 20 amp circuit without other electrical loads.

Failure to adhere to these instructions could result in electrical shock, fire, and/or damage to your charging system and vehicle.

If you have any questions, please call Solectria at (508) 658-2231.

Once the car is plugged in, the charger will turn on automatically. When the battery is charging, the green **IN** LED on the Amp-Hour Meter blinks, and the Amp-Hour Meter counts down toward zero. To avoid ever returning to a partly or fully discharged vehicle, it is a good practice to briefly check the Amp-Hour Meter each time you plug in the vehicle to confirm that it is truly charging.

Under normal conditions, the charger will overcharge the batteries slightly, so the Amp-Hour Meter will read between 00.00 and -05.00 when the charging is complete. This is due to an inefficiency of charging and is normal. Once an electrical load is applied (e.g., if the interior dome light turns on), the meter will automatically reset to 00.00 to give an accurate measure of the total energy consumption from the battery.

The charger is automatic and will turn off automatically when the batteries are fully charged. Leaving the vehicle plugged in after charging is complete will not harm the battery or the charger, and is recommended.

Your Force's charger has been tuned at the factory for the specific

battery in your car, according to the battery manufacturer's recommendations. This means that the charging system provides the optimal charging sequence for your battery for efficient charging and long life of the battery.

As new battery technologies are developed or as charging procedures are updated by the battery manufacturers, Solectria can, if necessary, reprogram your Force charging system to accommodate the new procedures. In order to ensure that the charging system uses the proper charging profile, please notify Solectria before replacing your Force battery pack.

Your Solectria Force is equipped with sealed, starved electrolyte lead acid batteries. This vehicle should be kept plugged in whenever possible. This will greatly extends battery life by ensuring that the batteries stay at a high state of charge (SOC) and by preventing freezing problems during extended inactive periods during cold weather.

There is a green LED on the left side of the dash marked "CHARGE COMPLETE" that indicates that the vehicle has been fully charged. This will ensure that the battery is fully charged and that the vehicle maintains its range over many charge cycles. For more information about recommended charging procedures for your specific battery, read the information supplied separately on the battery pack or contact Solectria.

Starting

To turn on the motor controller in the Force, insert the key into the ignition and turn it forward (clockwise) to the "ON" position. You will not hear any engine noise, but do not be alarmed, as the car is silent when it is not moving.

Each time the controller is turned on, it performs a 1 to 2-second diagnostic check to make sure that the controller is performing properly. Once the diagnostic is performed, the car is ready to drive (see the following section, "Driving the Force").

Observe the Amp-Hour meter to see how much electrical energy (as measured in amp-hours) you have used from your battery. When the battery is fully charged the meter will automatically-reset to 00.00 (after it has been negative).

Note: the Amp-hour Meter counts up as you discharge the battery, and counts down as you charge the battery.

CAUTION!

Do not attempt to "crank the starter", by turning the key to the "start" position. Attempting this will not serve any function, but it may cause you to accidentally break the key in the ignition switch.

Driving

Once the car is turned on, **select a driving mode** using the Range-Power Selector. For maximum range and battery life, drive in the **ECON** mode. If more power is needed, shift to **NORMAL** or **POWER**.

Note: The Range-Power Selector may be shifted at any time, i.e., while the vehicle is moving, with your foot on or off the accelerator pedal, etc.

To drive, **depress the accelerator pedal about halfway** and the car will start to move.

The first half of the accelerator travel is the regenerative braking region, as explained in the following section, "Regenerative Braking," You must depress the accelerator halfway down (through this "dead zone") before the vehicle will begin to move. Once moving, the vehicle speed is regulated by the accelerator pedal, which tells the motor controller how much power to give to the motor (or draw from the motor during regenerative braking).

You do not need to shift gears while driving, as the Force has only one forward gear. However, if you need quick acceleration for safety, flick the Range-Power selector to the **Normal** or **Power** setting as you are driving. The vehicle speed is regulated by the degree to which you depress the accelerator pedal.

Note that as you draw more current from the battery or put more energy back into the battery, the red or green LED on your Amp-Hour Meter will flash proportionately. For extended range, as well as extended battery life, it is best to drive efficiently, by keeping the current into and out of the battery (i.e. the blink rate on the Amp-Hour Meter) as low as reasonably possible. For more information on efficient driving habits, see **SECTION V, EFFICIENT DRIVING.**

BRAKING

Regenerative Braking

As you release the accelerator pedal up past the mid-point, the motor controller will switch to regenerative braking(or "regen") mode to slow down the vehicle while at the same time generating electricity to partly recharge the battery.

When regenerative braking is active, notice that the green "**IN**" LED next to the Amp-Hour Meter will blink. This signifies that the battery is recharging with the electricity produced from the regen braking. This recaptured energy can be used by the vehicle when you demand more power from the battery. Regen therefore extends the range and also the life of the battery of your Force.

Regen braking uses the same motor, controller, drive train and battery that the vehicle uses to drive the vehicle, only in reverse. The same amount of power, or torque, which the motor provides to drive the car can also be used to slow the car down in regen mode.

Solectria limits the maximum regen power to somewhat lower than the maximum motor capability, but regen braking can still be quite powerful. To slow down smoothly during normal driving, the accelerator should be released more gently than in a conventional vehicle.

For rapid or emergency braking, full regen braking is engaged immediately upon releasing the accelerator.

Power Brakes

The standard hydraulic brakes may be applied at any time as in a conventional vehicle by use of the brake pedal.

With prudent driving and appropriate use of regen braking, frequent use of the brake pedal should not be required. The brake pedal will give you fast deceleration for quick stops, but does so by quickly using up the energy of motion in the car through heating and wearing down the brake pads. Since regenerative braking does recapture and store some of that energy in the battery for additional use, Solectria recommends that you maximize the use of regen braking to slow the vehicle under normal driving conditions. This may require an adjustment to your driving style so that most if not all deceleration is performed with regenerative braking.

The regenerative braking system is connected to your rear brake lights. As you release the accelerator through the mid-point, the motor controller begins to apply regen braking and the green "**IN**" LED by the Amp-Hour

Meter begins to blink slowly. As you continue to release the accelerator, and the regen increases to a level stronger than "engine braking", the controller turns on the rear brake lights, indicating to the drivers behind you that the car is actively braking. The brake lights for regen are activated by a relay located under the dash which may be heard clicking as the regen lights turn on or off. Lifting your foot off the accelerator completely applies maximum regen. Regen braking can be disabled with the switch located on the floor console.

WARNING!

Under extremely slippery road conditions, such as on icy or snowy roads, set the regen braking switch to "SLIPPERY" to turn off the regen braking. Regen applies braking to your front wheels only, and under slippery conditions could cause wheel lock-up and/or sliding. Caution must be exercised when using *any* braking under these conditions.

Once the vehicle slows to about 3 mph, regen braking slowly releases, and the vehicle is free-rolling. Regen braking will not bring the vehicle to a complete stop, nor will it "hold" the vehicle on a hill. To ensure that the vehicle completely stops and remains stopped, you must apply the hydraulic brakes, as in a conventional car. (You can also use the parking brake to hold the car at a stoplight on a hill.) Without the hydraulic brake on, the vehicle may roll. Solectria recommends that you always keep your foot on the brake pedal when the vehicle is stopped.

Parking the Vehicle
To park the vehicle, bring the vehicle to a complete stop, and place the Range-Power Selector to **OFF** and ALWAYS set the parking brake.

A reminder tone will sound if you fail to set the parking brake.

When exiting the vehicle always leave the Range-Power Selector in **OFF** and remove the key from the ignition. If parking on a hill, turn the wheels towards the curb to prevent the vehicle from rolling should the parking brake fail.

Range
At a constant 45 mph and with no use of accessories, the Solectria Force will travel at least 50 miles at a constant 45 mph. Highway driving, frequent stop and go driving, and use of accessories (especially heat and air conditioning) can significantly decrease the range.

Energy Use
The Solectria Force sedan battery pack can provide a maximum of about 50 amp-hours of energy (according to the dash-mounted Amp-Hour Meter) before the car begin to slow down appreciably.

Note: If possible, it is best to recharge the battery before it reaches this state of depletion.

The Force's energy consumption can vary from 1 amp-hour per mile to 2 or more amp-hours per mile. This means your vehicle range can fluctuate between 50 and 25 miles, depending on how it is driven, terrain, use of accessories, etc. Once you become familiar with the vehicle's energy consumption under different conditions, you will have a better sense of how much range to expect per charge for the given road conditions.

Your Force uses highly efficient components, and is designed to have the best range possible while still maintaining a safe vehicle weight. However, because it's range is significantly less than a gasoline, efficient driving efficiently is particularly important.

As with your gasoline vehicle, your rate of energy consumption will depend on the type of driving you do, the terrain, and your driving techniques. Given that you have a much smaller amount of energy to start with, driving efficiency is much more crucial than in a gasoline car. Please refer to **SECTION V, EFFICIENT DRIVING** for tips on driving more efficiently.

Comfort Controls

Heat
Press the Red button on the console labeled **HEAT** to turn on the Force electric heater. You may regulate the amount of heat by adjusting the fan speed control.

Note: The heater fan must be turned on in order for the heater to operate.

Air Conditioning (Optional)
Push the square black button on the dash labeled **A/C**, and turn on the fan to operate the air conditioner. Sliding the lever to the "recirculate" mode will help your vehicle cool faster and will reduce the drain on the batteries. Driving for the first few minutes with the Air Conditioning off and the windows open may help to disperse the hot air inside the car quickly; then close the windows and turn the air conditioner on to bring the passenger compartment to a comfortable temperature.

Remember that both the heating and air conditioning run directly off your battery. Using them will decrease your range by 10-15% or more depending on your heating or cooling usage, driving conditions, etc.

IV. THE ELECTRIC DRIVE SYSTEM AND OTHER COMPONENTS

Drive System
The electric drive system is what makes the Force a unique vehicle. It is important that you understand the basics of its operation and how it works.

Motor Controller
The "brains" of the system are housed in the highly efficient Solectria AC motor controllerwhich sits on top of the front battery box. It controls and coordinates all functions of the electric motor, regenerative braking and the battery during the operation of the vehicle.

Battery Boxes
Directly below the controller is a large black battery box that houses some of the batteries. The remainder of the battery pack is located in a rear battery box below the trunk. These two battery packs are connected in series to form the battery pack of the vehicle, which stores the energy that your car uses, much as a fuel tank on a conventional vehicle does.

Batteries
Your Solectria Force is equipped with sealed, starved-electrolyte lead acid batteries. These batteries are maintenance-free and have minimal free electrolyte available for spillage during a major accident. The Force battery pack voltage is nominally 156 V DC.

Battery Thermal Management System
The battery boxes may be equipped with Solectria's optional automatic battery thermal management system, which insures that the battery is maintained at a suitable working temperature through the cold weather months.

This system is critical for maintaining vehicle range and longevity of the battery during cold weather. In addition, lead acid batteries can freeze under extremely cold weather, especially if they are at a low state of charge. Whenever temperatures are below 50°F, the vehicle should be kept plugged into an AC outlet as much as possible to maintain a fully charged battery and optimal battery temperature.

In general, it's best to keep the car plugged in whenever it is not in use.

Motor
The silver cylinder with cooling fins mounted under the hood is the drive motor which propels the vehicle or slows it down during regenerative

braking. The motor is coupled to the drive axles by Solectria's direct drive gearbox. Active air cooling of the motor is provided by a thermally controlled fan.

When you depress the accelerator, an electronic signal is sent to the controller, which then converts DC current from the battery to AC current of an appropriate form to drive the motors (or vice versa in the condition of regen braking). Solectria's efficient AC motors and controllers produce sufficient torque at low speed, and spin fast enough (up to 12,000 rpm) that a single gear ratio is adequate for all normal driving conditions. Therefore, the Force does not have separate gearing and does not require "shifting gears" automatically or manually. Thus, unlike most gas vehicles with multiple gearing, the speed of the Force is determined solely by the speed of the motor.

Overheat Protection
Solectria's Force drive system is highly efficient, ranging between 70% and 90% overall for the motor controller and motor. In spite of this high efficiency, under high power requirements the motor and controller will produce a lot of heat. Both the controller and motor are equipped with thermally-switched cooling fans to maintain operating temperatures under heavy load.

Under very conditions of hot weather and extended high power demand, the controller may reach its maximum operating temperature and shut down, to protect the electronics in the controller. Once the controller has cooled down for a few minutes, the controller will automatically restart and allow driving of the vehicle.

Limp Home Mode
The Force will provide consistent performance throughout most of the discharge cycle of the battery. As the battery reaches a 20% state-of-charge (SOC), the motor controller begins to limit the current available from the battery. This prevents irreversible damage being done to the battery. The Force will operate under this progressively diminishing performance condition (or "limp home mode") for 5 miles or more. Once the battery reaches approximately 10% SOC, the motor controller will shut down to protect the battery, and the car can no longer be driven under its own power.

System Voltage
All of the electrical drive components of the Force (i.e. the battery, motor controller and motor) and interconnecting wiring are potentially at or above the nominal battery voltage of 156V.

In addition, the battery charger, Amp-Hour Meter shunt, DC-DC converter

input cables, air conditioner motor and controller cables and heater cables, are all at the high voltage of the traction battery. Although the high voltage circuit is completely isolated from the vehicle chassis and the 12 V DC system, extreme caution must be exercised whenever handling any high voltage component.

All servicing of high voltage components must be performed by experienced, qualified service personnel. Treat all connectors and conductors as live until they are verified to be de-energized by proper monitoring equipment. **Failure to follow these rules may result in electrical shock, fire, damage to the vehicle and other property and possibly death.** Please notify Solectria or a Solectria representative whenever you have electronic problems or traction battery problems. Do not attempt to make repairs on your own.

Power Brakes
The Force hydraulic brakes are power-assisted, using the original Geo Metro power brake assembly. The vacuum for the power brake system is provided by a vacuum pump and vacuum canister located under the hood.

DC-DC Converter
The electrical accessories in the Force are powered indirectly by the main traction battery through the DC-DC converter, which provides 12-V DC power for lights, radio, etc. The 12V system is chassis-grounded as in gasoline vehicles and is completely isolated from the high voltage electrical system. The electric heaters operate at main battery pack voltage rather than operate through the DC-DC converter.

V. EFFICIENT DRIVING

Your Force vehicle has been carefully designed to provide good performance in the city and on the highway. However, the tips in this section allow you to get the best range possible, achieve longer battery life, and conserve energy.

Cruising
For maximum efficiency, accelerate gradually to the desired cruising speed, and then try to maintain a constant speed. Stopping and starting uses a considerable amount of energy even with the regenerative braking feature with which your car is equipped. Anticipate the need to slow down so that deceleration is gradual and stopping is averted as much as possible.

Maintain a slow, steady cruising speed. Data collected by Solectria show that the energy consumption of your Force increases dramatically with speed. Slower cruising speeds not only save energy and extend vehicle range and battery life, but also save lives.

Your energy consumption will depend on your particular driving habits and driving conditions.

Acceleration
The Force has been equipped with good acceleration capability for safety and enjoyment. Although using the full acceleration often does not significantly increase wear on any electronic or drive train components, it does take a toll on the batteries, and causes the vehicle to use more energy, thereby decreasing the vehicle's range.

The faster you discharge the vehicle's battery, the less total energy, or amp-hours, the battery can provide. High-power and high-acceleration driving not only uses up the battery's energy more quickly but also decreases the total amount of energy available from the battery. Because of this effect, "hot rodding" can decrease the vehicle range by as much as 30% or more.

To maximize your range and efficiency, accelerate gently and anticipate slow downs to enable you to decelerate gently. Decelerating gently will allow you to get the most benefit from the regenerative braking.

Driving Modes
The **ECON** setting on the Range-Power Selector limits the current drawn from the battery by the controller. This current limit reduces the maximum power output of the motor, and therefore limits the effect of "jack rabbit" starting. Setting the Range-Power Selector to **ECON**

increases overall energy efficiency while lowering vehicle performance.

In the **NORMAL** or **POWER** modes, the vehicle's efficiency can be considerably reduced. With the high power acceleration and high speed driving capacity of the Force, the car may use as much as 1.5 to 2 amp-hours per mile, or up to 50% more than the consumption at a more restricted, efficient **ECON** mode setting. For maximum benefit, Solectria recommends that you drive in the **ECON** mode as much as possible.

Hill Climbing
Hill climbing is an energy-intensive task. However, the more slowly you climb, the less power is required. To be efficient, it is recommended that you climb hills slowly, if possible.

The red "**OUT**" LED by your Amp-Hour Meter flashes quickly when you are using a lot of power and slowly when you are using less power. The lower the power used, the more range you will get per battery charge. As a rule, try not to let the red LED blink so quickly that it appears to be solidly lit for extended periods of driving. This indicates that you are using excessive power and not driving efficiently! The more slowly this red LED blinks, the more miles you will get per charge.

VI. REPORTING SAFETY DEFECTS

If you believe that your vehicle has a defect which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Solectria Corporation.

If NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or Solectria.

To contact NHTSA, you may either call the Auto Safety Hot Line toll-free at 1-800-424-9393 (or 202-366-0123 in the Washington, DC area) or write to: NHTSA, U.S. Department of Transportation, Washington, DC 20590. You can also obtain other information about motor vehicle safety from the Hot Line.

VII. MAINTENANCE SCHEDULE

The purpose of maintenance is to ensure that your vehicle is safe to drive at all times and to maximize the life of all parts of your car. It is possible that you may use your car more or in worse conditions than are anticipated by this maintenance schedule, but it should be adequate for normal commuting and around town driving. The schedule is specifically designed for cars that:

o carry passengers and cargo within the recommended limits. The limits can be found on the edge of the driver's door.

o are driven on reasonable road surfaces within the legal driving limits.

Based on this, there is one recommended maintenance schedule for your Force automobile. Refer to the 1997 Solectria Force Maintenance Schedule included in this section.

Specifically, six items should be performed by knowledgeable service personnel on a periodic basis. These six items are listed and described below. Please refer to the 1997 Solectria Force Service Manual for a more complete description of these tasks.

Warranty Card
For your vehicle's warranty to remain valid, your vehicle's Warranty Card must be filled in each time Scheduled Maintenance takes place. We recommend you keep the Warranty Card with the Owner's Manual in the glove box of the vehicle.

Rotate/inspect tires
For long wear and maximum tire life, rotate your tires following the instructions in the Geo Metro Owner's Manual. Check the tires for uneven wear or damage. If you see irregular or premature wear, check the wheel alignment. Check for damaged wheels as well. While tires and wheels are removed for inspection, perform brake system inspection.

Change gearbox oil
Remove the belly pan. Drain the transmission. Refill with 1 qt. Dextron® III ATF. (Refer to the Solectria service manual for more specific instructions.)

Inspect gearbox oil level
Looking from underneath the vehicle, with the front wheels turned full left, observe the sight glass on the transmission. (It is located on the driver's side near the inner axle joint.) The fluid level should be visible near the mid-point of the window.

Inspect steering & suspension
Inspect the front and rear suspension and steering for worn, damaged or loose parts, or for lack of lubrication. Inspect the drive axle boots for cracks, holes, or leakage. Replace as necessary.

Inspect brake system
It is easiest to do this when the wheels are removed for rotation. Inspect lines and hoses for proper hook-up, binding, leaks, cracks, chafing, etc. Inspect disc brake pads for wear and rotors for surface condition. Also inspect drum brake linings for wear and cracks. Inspect other brake parts, including drums, wheel cylinders, parking brake etc. Check parking brake alignment. You may need to inspect your brakes more often if your driving habits or conditions result in frequent braking. (If you are careful and use your regenerative brakes whenever braking is required. It will result in less wear on your conventional brakes and less maintenance expenses.) Check the brake fluid level.

Change brake fluid
Drain, refill, and bleed the brake system. Clean and repack the front wheel bearings (or at each brake relining, whichever occurs first).

OWNER/OPERATOR INSPECTIONS

In addition to the items listed above, several inspections (including tire pressure check, windshield washer fluid level check, etc.) should be performed by the Owner/Operator of the vehicle on a weekly, monthly, biannual, or annual basis. These items are listed and described below.

Weekly

Check windshield washer fluid level
Check windshield washer fluid level in the windshield washer tank and add fluid if necessary.

Check hood latch operation
Pull the hood release inside the car. The secondary latch should keep the hood from opening all the way. Make sure that the hood closes firmly.

Monthly

Check tire pressure
Check tires for proper pressure; if they appear low, inflate to maximum level specified on the tire sidewall. If they are worn

unevenly, check 4 wheel alignment.

Every 6 months

Check restraint system
Inspect belt system, including: webbing, buckles, latch plates, retractors, guide loops and anchors. Have the belt assembly replaced if the webbing has been cut or otherwise damaged.

Check wiper blades
Inspect wiper blade performance during use. If wipers are not effective at clearing the windshield, replace as necessary.

Once a year

Lubricate key lock
Lubricate the key lock cylinders with the lubricant specified in the List of Lubricants at the end of this section.

Lubricate body
Lubricate all door hinges, rear compartment hinges, latches, and locks including interior glove box and console doors, and any moving seat hardware. Lubricate the hood safety lever pivot and latch mechanism. More frequent lubrication may be required when exposed to a corrosive environment.

Check steering column lock
While parked, and with the parking brake set, turn the key to LOCK, remove it, and ensure that the steering wheel is locked. Insert key, turn to ON and ensure that the steering wheel has full play.

Check parking brake performance

WARNING!
The vehicle could move during this check. Make sure there is sufficient room in front of the vehicle so that, should it roll, you could stop it with the foot brake without injury to people or damage to property.

Park on a fairly steep hill, with the vehicle facing down hill. Keeping your foot on the regular brake, set the parking brake. Place the vehicle in **OFF** so that the motor is not applying any braking or motive force to the

vehicle. Slowly remove foot pressure from the regular brake pedal. Do this until the vehicle is held by the parking brake only. See your GEO dealer immediately if the vehicle cannot be held in place with this test. Should this occur, use extreme caution and park only level ground to prevent the vehicle from rolling unintentionally.

CAR WASH INFORMATION

CAUTION!

Although the possibility is slight, there is a chance that spraying large volumes of pressurized water into your car from an automatic car wash could cause short circuits resulting in damage to the auto and/or injury to yourself. In general, it is safer not to use most car wash facilities and to hand wash your Force.

LIST OF FLUIDS AND LUBRICANTS

Hydraulic Brake System	Delco Supreme 11® Brake Fluid (GM Part No. 1052535 or equivalent DOT-3 brake fluid.)
Key Lock Cylinders	Lubricate with Multi Purpose Lubricant, superlube® (GM Part No. 12346241) or equivalent.
Chassis Lubrication	Chassis lubricant (GM Part No. 1052497 or equivalent) or lubricant meeting NLGI Grade 2, Category LB or GC-LB.
	Wheel bearing lubricant meeting the requirements of NLGI Grade 2, Category GC or GC-Lb (GM Part No. 1051344 or equivalent)
Weather-strip	Silicone grease (GM Part No. 1052863) or equivalent.
Air Conditioning	R134A (26 oz. system empty)
Transmission oil	Dextron® III Automatic Transmission Fluid

Maintenance Locations

Routine scheduled maintenance of your car body, disc and drum brakes, wheels, tires, etc. can be performed at any service station or Geo Metro dealer.

Electronic and electric drive system maintenance must be performed by Solectria or a Solectria-approved repair facility. Presently, Solectria's main facility is located at 33 Industrial Way, Wilmington, MA 01887, USA tel 508-658-2231, fax 508-658-3224.

Scheduled Maintenance

Item	Odometer (miles) 6,000	12,000	18,000	24,000	30,000	36,000	42,000	48,000	54,000	60,000	66,000	72,000	78,000	84,000	90,000	96,000
Rotate/inspect tires	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Change gearbox oil	x	x		x		x		x		x		x		x		x
Inspect gearbox oil level			x		x		x		x		x		x		x	
Inspect steering & suspension		x		x		x		x		x		x		x		x
Inspect brake system		x		x		x		x		x		x		x		x
Change brake fluid										x						

Owner/Operator Inspections

Weekly
Check windshield washer fluid level
Check hood latch operation

Monthly
Check tire pressure

Every 6 months
Check restraint system
Check wiper blades

Once a year
Lubricate key lock
Lubricate body
Check steering column Lock
Check parking brake performance

VIII. WARRANTY/REPAIR

Solectria maintains a very high customer satisfaction record and we want you to be completely satisfied with your new Force automobile. It is very important that you fully understand how to operate your car, and so we highly recommend reading the entire Owner's Manual.

In addition to the following information, please see Solectria's Vehicle Warranty Policy for full details.

Maintenance and Repairs
Maintenance and repairs can be performed by any qualified service outlet; however, ***warranty repairs must be performed by a Solectria-authorized dealer or service provider***. Please contact Solectria Customer Service if you have any questions concerning an appropriate service facility.

Note: Any removal and re-installation of components must be performed by a trained technician. (Most Solectria components are modular and can be removed by disconnecting a few contacts or loosening a few screws.)

Note to NJ Transit Program Participants

With the exception of the Non-Warranted Items listed below, your vehicle is covered by a three-year warranty. If you have any problems with the Solectria components in your vehicle, please contact Solectria Corporation's toll-free technical assistance hot-line (1-888-FIX-EV97, or 1-888-349-3897) for assistance and instructions.

If you experience problems with the Geo Metro parts in your vehicle, please contact the specified Geo Metro dealer in your area to arrange for warranty or non-warranty work, as appropriate.

After business hours, please call AAA in NJ and have the vehicle towed to the nearest Solectria-authorized Service Provider.

If you are unsure how to proceed, please call Solectria Customer Service.

Non-Warranted Items
Antenna
Batteries (see exception for NJ Transit Program Participants, below)
Belts

Brake drums
Brake linings
Brake pads
Brake rotors
Bulbs
Cords
Fuses
Mirrors
Plugs
Shock absorbers - rear
Springs - rear
Struts - front
Tires
Windows
Windshield wash fluid
Wiper blades

Other Exclusions
The vehicle's warranty also does not cover any damage caused by vandalism, abuse, neglect, acts of God, etc. Also, it does not cover any other item outside of the manufacturer's control.

Note to NJ Transit Program Participants on Batteries
Batteries are covered by a 1-year, 12,000 mile warranty, whichever occurs first. Beyond this point, batteries will be considered non-warranted wear items as well.

Warranty Card
For your vehicle's warranty to remain valid, your vehicle's Warranty Card must be filled in each time Scheduled Maintenance takes place. We recommend you keep the Warranty Card with the Owner's Manual in the glove box of the vehicle.

Receipts concerning regular maintenance should be retained in case questions arise concerning maintenance. Solectria reserves the right to deny warranty coverage if the vehicle has not been properly maintained. However, this decision would not be based solely on the absence of maintenance records.

Solectria Corporation can be contacted at (508) 658-2231 to effect all necessary warranty repairs. If you are not in the vicinity or are unable to bring your car to our Massachusetts facility, you may use an authorized Service Provider after contacting us. Once we confirm by phone, fax or letter, have the car serviced and we will reimburse the repair facility directly.

NOTE: Chevrolet/Geo dealers are probably the best source for conventional car parts for the Solectria Force.

CAUTION!

Do NOT attempt to open or repair "damaged" components. Doing so will completely void the warranty on that part and may present a hazardous situation.

Before removing any item, call us with information on the problem. After receiving authorization to remove the component in question, ensure that a trained person is on hand to remove the item.

When disconnecting contacts, confirm that the technician knows exactly how to reconnect parts as incorrect wiring reconnections can damage components.

Service personnel should promptly package the defective or broken component and send it back to Solectria after calling Solectria Customer Service in advance to obtain a RMA (Return Merchandise Authorization) number for tracking this return.

Transferability
This warranty is applicable to cars registered in the U.S. and normally operated in the U.S. It is provided to the original owner only and is not transferable.

Note to NJ Transit Program Participants

In the case of your vehicle, the vehicle operator or lessee may present the vehicle for warranty service. For this program, the warranty is transferable to the Operator/Lessee of the vehicle.

For more information on our warranty options, please ask.

Repair Locations
Repair of your car body, standard transmission, disc and drum brakes, wheels, tires, etc. can be performed at any service station or Chevrolet/Geo Dealer.

Electronic and electric drive system repairs must be performed by

Solectria or a Solectria-authorized Service Provider. Presently, Solectria's main facility is located at 33 Industrial Way, Wilmington, MA 01887, USA, tel 508-658-2231, fax 508-658-3224.

Solectria Corporation reserves the right to make changes, improvements and alterations in cars that it builds without incurring the obligation to make similar changes on earlier models of Solectria cars.

If you ever have any questions about your warranty or repair information in general, please feel free to contact Solectria for assistance at 508-658-2231.

IX. TROUBLESHOOTING GUIDE

The purpose of this section is to give you, the owner or operator of the vehicle, some guidance on what to do if you suspect or know that something is wrong with the car.

NEVER open up the motor controller, the DC-DC converter, or any other sealed piece of electronic equipment. Doing so could damage the car and cause severe injury to yourself.

Below are some common problems and how to address them.

A. Car will not start

1. First, check your Amp-Hour Meter to make sure you have power.

2. Make sure that you have unplugged the car—it will not start if the car is plugged into a charging outlet.

3. Have you tried driving it? Remember, you really don't hear anything when you turn your car on.

4. Check that your key is inserted in the ignition switch and is in the "on" position (2 clicks). If you are not sure, turn everything off, wait a few seconds, insert the key, turn to the "on" position, and wait 1-2 seconds.

5. Move the Range-Power Selector to **OFF,** then set the Range-Power Selector to the desired mode.

6. Release the parking brake fully.

7. If the car still doesn't drive, the problem could be mechanical or electrical. Check to see if the lights, horn, or radio operate properly. If not, listen carefully for the whine of the motor and controller as you depress the accelerator.

If the motor does not spin at all, the problem is electrical. In this case, we recommend contacting a Solectria Repair facility which will check all electrical connections from the battery box to the motor.

CAUTION!

WORKING WITH HIGH VOLTAGE SYSTEMS IS DANGEROUS, AND CAN RESULT IN SERIOUS INJURY IF DONE IMPROPERLY. IT MUST ONLY BE ATTEMPTED BY TRAINED TECHNICIANS. PLEASE CALL SOLECTRIA BEFORE ATTEMPTING ANY ELECTRICAL REPAIRS.

B. Car will not charge

1. If you have plugged your car into a wall outlet and the green **IN** LED on your instrument panel is not flashing, this indicates that you are not getting any power to your battery. Unplug your car.

2. Check the outlet to make sure it is getting power by plugging in another device such as a lamp. If the circuit breaker tripped or the fuse is blown, make sure the circuit is rated for the power that the charger require (20 amps).

3. Listen for a relay clicking when plugging the car in. Listen for the charger cooling fans to turn on. If either occurs, indicating that the charger is receiving power, check the Amp-Hour Meter. If the green **IN** LED is not flashing, watch the numbers on the counter. If they are decreasing, then the car is being charged, but the green LED is bad. Call Solectria for repair information.

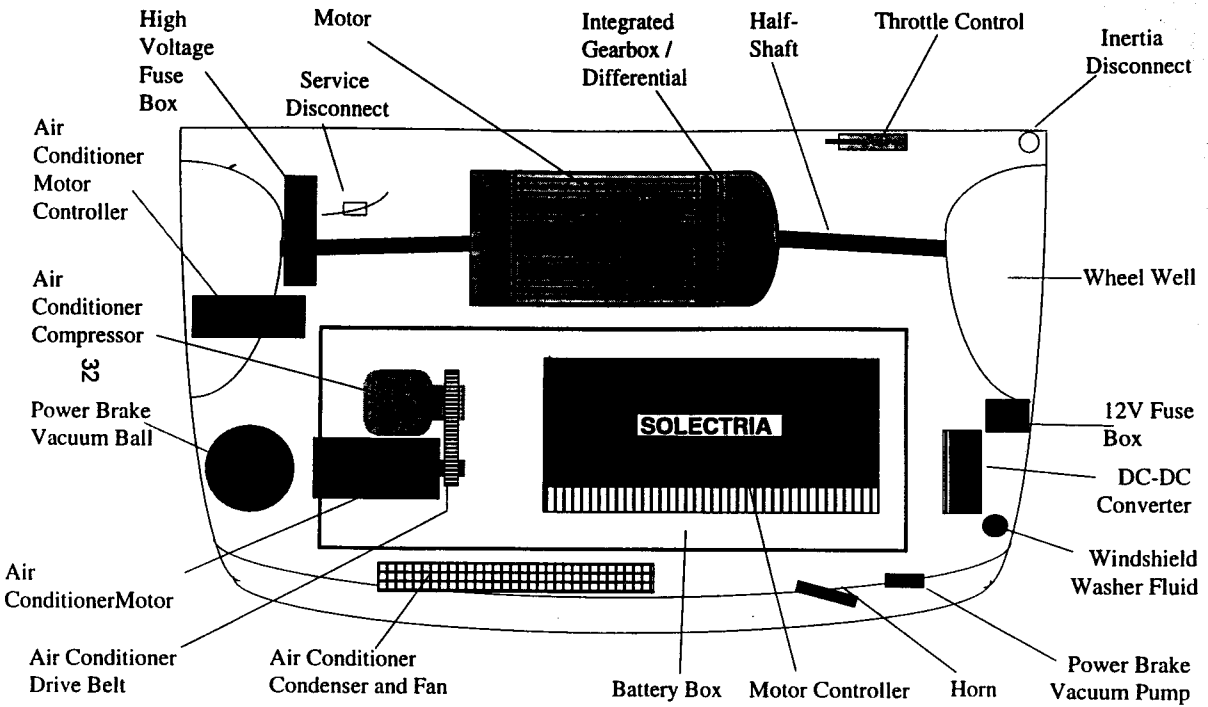
5. If the car still is not charging, call Solectria.

C. Batteries are not recharging or are not holding a full charge

1. This may be due to improper or insufficient charging. Please call Solectria at 508-658-2231 for more assistance.

2. Note: Rough driving can cause damage to batteries which may not be visible on the outside. Internal damage may cause the batteries to have a shorter life and reduced charging ability.

X. DIAGRAM - 1997 Solectria Force Motor Compartment



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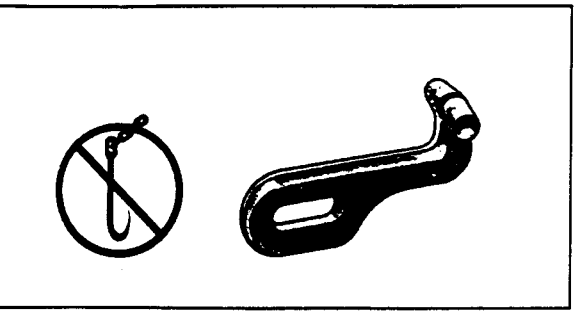
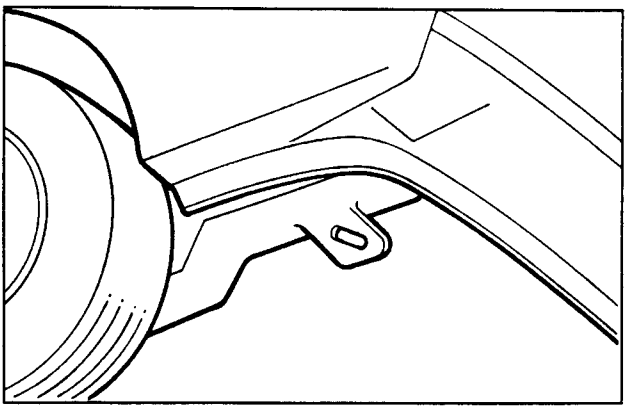
Towing Instructions for 1997 Solectria Force

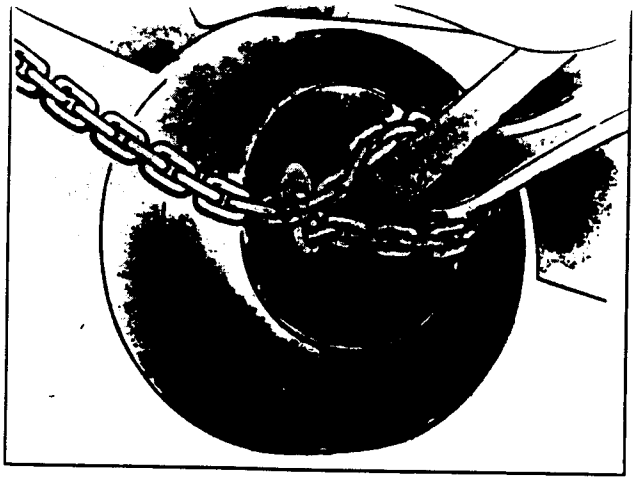
Do not attach winch cables or "J"-hooks to suspension components when towing.



Always use "T"-hooks inserted into the "T"-hook slots. See diagrams.

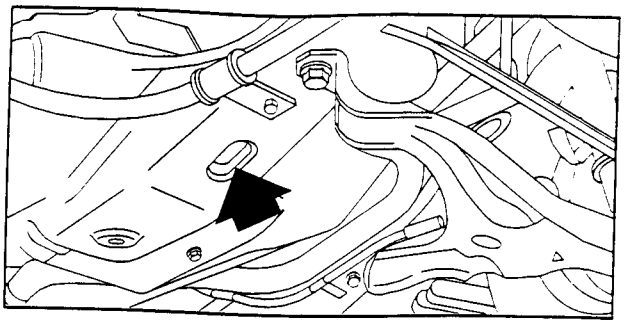


Attach T-hook chains on both sides, in the slotted holes in the brackets, just ahead of the front wheels.



Attach a separate safety chain around the outboard end of each lower control arm.

Do not wrap chain around track rods, sway bars, tie rods, or brake lines.



Attach T-hook chains to the T-hook slots in the bottom of the floor pan just ahead of the rear wheels on both sides.

Addendum #1

1997 Solectria Force Owner's Manual
New Jersey Project: Power Commute

Special Options

Your Solectria Force is equipped with several special options. We encourage you to take a moment to learn about their operation.

Inertia Disconnect Switch
Located under the hood, this device shuts off power to the drive system when the vehicle has experienced a sharp bump or impact. See text in Owner's Manual for more details.

Back-Up Alarm
When you select "REVERSE", a back-up beeping tone will automatically sound. The beeping will be louder when more background noise is present, and will stop when you set the Range-Power Control back to "OFF" or one of the forward settings.

Parking Brake Alarm
An reminder alarm has been added to the parking brake, which must be used every time the vehicle is parked to prevent unintentional rolling of the vehicle. When parking the vehicle, pull up the parking brake until the alarm discontinues to secure brake firmly. (Note: Parking brake alarm will sound only when key is off.)

If you have any questions, please call Solectria Customer Service at 508-658-2231.

April 1997

Addendum #2

1997 Solectria Force Owner's Manual
New Jersey Project: Power Commute

Inertia Disconnect Switch Update

Due to a design and manufacturing change, use of the Inertia Disconnect Switch has been discontinued. If an Inertia Disconnect Switch is still present in your vehicle, this switch either has been or should be disconnected so that it is no longer operational. If you have any questions, please call Solectria Customer Service at 508-658-2231.

June 1997