AMERICAN LANDMASTER

OWNER MANUAL / SAFETY MANUAL

ELECTRIC VEHICLE

THE LATEST VERSIONS OF THE WIRING DIAGRAMS AND ILLUSTRATED PARTS LISTS ARE ONLINE AT AMERICANLANDMASTER.COM

05/21/2021

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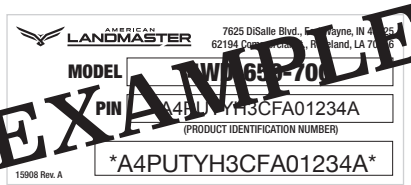
YOUR PRODUCT IDENTIFICATION NUMBER (PIN)

Making sure your PIN is noted correctly greatly reduces any delays in getting help with parts, accessories or any warranty work.



MODEL:

17 CHARACTER PIN:

A	4	P														
letter / digit / letter			letter/digit	letter/digit	letter/digit	letter	letter/digit	letter	letter	letter	letter	digits / letters				

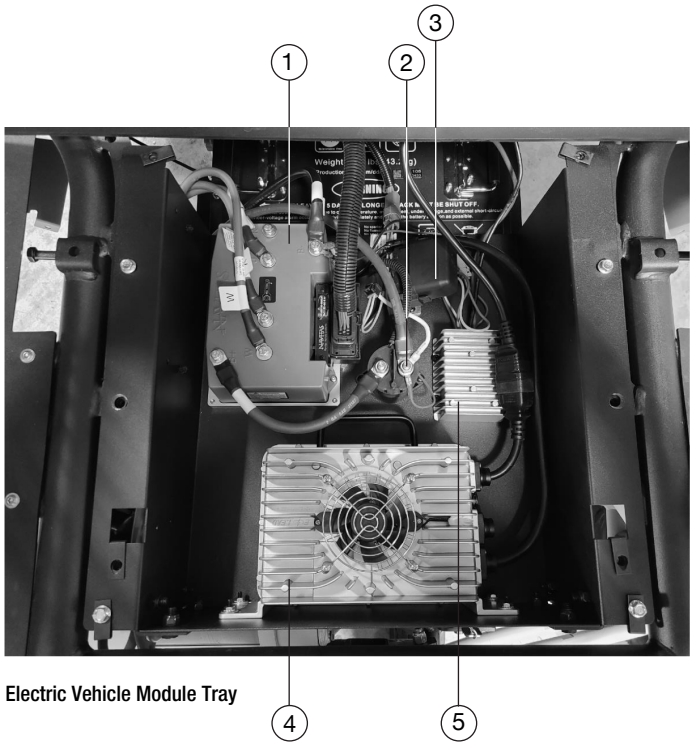
THE PIN PLATE IS LOCATED BELOW THE UTV STEERING WHEEL

section 1 electric vehicle

OVERVIEW

The American Landmaster Electric Vehicle is a completely new design versus our previous legacy electric models. The new EV is built upon the same rugged chassis as all of our gasoline engine models. Superior ride and handling with the trailing arm suspension and new shocks are paramount to the design. All new EV DRIVE components are built into this electric vehicle. The heart of the design is an AC motor and Controller from Navitas. This integrated package provides a turn-key system packed with performance and customer focused features. The system provides up to 16 peak horse power for tough applications. Fast acceleration and long distance operation on a single charge provides the customer with reliable performance without the noise, fumes and maintenance of a gasoline engine. Diagnostics and key programmable parameters are managed through a Bluetooth smart phone application.

Navitas Motor Drive



Electric Vehicle Module Tray

1	Navitas Motor Controller
2	48 Volt Power Converter
3	EV Fuse / Relay Box
4	48 Volt Battery Charger
5	48 to 12 Volt Converter

The motor's controller is located in a housing tray behind the driver seat. The battery charger and other supporting components are also located in this housing. The housing is equipped with a plastic lid to keep debris away from these parts. Removing a few screw fasteners and these parts are easy to access and easy to service.

The second major component of the EV system is the lithium battery pack that provides more than 3500 re-charge cycles. This battery should last the life of the vehicle. Two different battery sizes are available depending upon the needs of your application, i.e. 105 amp hour versus 160 amp hours of operation. The operator is kept informed on the state of charge of the battery through an intelligent ten segment display on the dash. The Lithium battery packs shown below provide at least a 200 pound weight savings versus traditional lead acid batteries. These batteries allow a deeper discharge and provide a longer mileage range than lead acid batteries.

Navitas Motor Drive

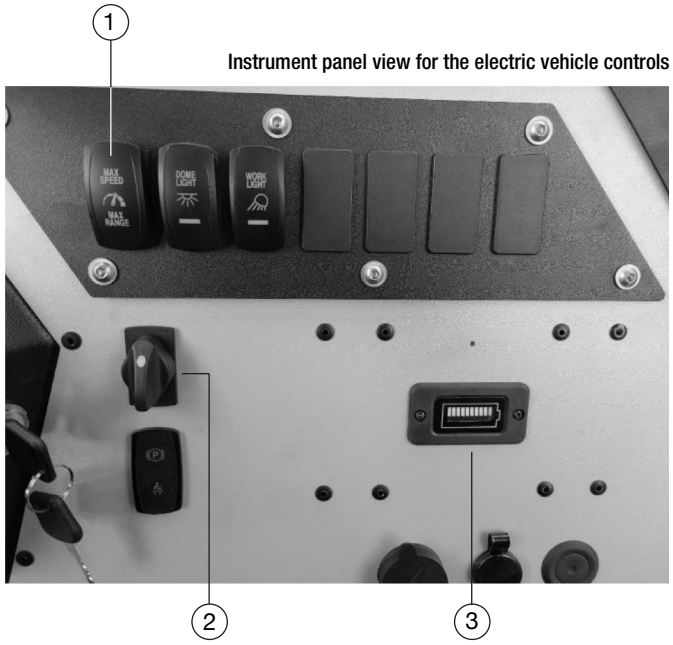
48 Volt 160 Amp Hour Battery

The flexible nature of the Landmaster electrical system allows the customer to order any of our existing electrical options on the electric vehicle, except the winch which shall not be offered until sometime in the future. Many common electrical components are also used on the electric vehicle. Even the main instrument panel harness is common across all models. Head lights, tail lights, horns and switches are also common for all models for simplicity and convenience.

SYSTEM OPERATION

The operation of the electric vehicle is designed to be very simple. The vehicle is designed to only operate with the ignition key in the ON position. No electrical features will work with key off except the electric horn, snowplow feature and the bed lift feature, if equipped. There are only two switches and a ten segment display associated with the system. The lithium battery pack also has an ON/OFF switch as well.

Driving the vehicle is as simple as turning on the battery, turning the ignition key to the ON position, placing the gear selector in the Forward position and then drive away. A more detailed description of each control and system operation is shown below.



Instrument panel view for the electric vehicle controls

1	Speed Mode Switch
2	Gear Position Switch (Rerverse, Neutral, Forward)
3	State of Charge Display

Gear Position Switch

The gear selection for the electric vehicle is controlled with a three position rotary switch located in the central instrument panel area.

- Neutral gear is attained with the switch in the middle position.
- Reverse gear is attained with the switch in left most position.
- The forward drive gear is attained with the switch in the right most position.
- The gear selector switch provides a lighted indicator for each gear selected.
  - *Red for Reverse*
  - *Green for Neutral*
  - *Blue for Drive*

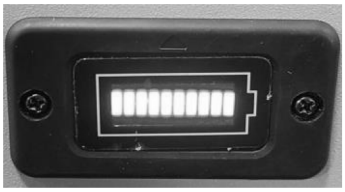
Max Speed / Max Range Switch

The Max Speed / Max Range Switch is equivalent to a Rabbit / Turtle switch on legacy electric vehicles. This switch modifies the speed and acceleration behavior of the vehicle. The Max Speed position provides a Rabbit or fast mode of performance. In this mode, you will get fast road speed and greater acceleration, but you will diminish the distance that can be traveled on a single charge. In the Max Speed mode, the vehicle will be capable of achieving a maximum programmed road speed. In off road applications, the factory default setting will be 30 MPH. For on highway applications, the vehicle will be capable of achieving 24 MPH.

The Max Range Switch position is equivalent to the Turtle or slow mode of performance on legacy electric vehicles. The Max Range mode will limit road speed to 12 MPH and will limit acceleration to 50% of the Max Speed switch position. This switch position will provide the longest distance to travel on a single charge. Use this switch position when you know you will need to travel for extended distances or you want the vehicle top speed to be reduced for your application.

Battery State of Charge Display

The Electric Vehicle is equipped with an intelligent State of Charge Display. Many competitor vehicles only provide a low battery warning light or a battery level meter based upon voltage which can be very inaccurate. The American Landmaster Electric Vehicle provides a true State of Charge display as calculated by the battery management system within the Lithium battery pack. The display provides 10 segments that each indicate a 10% state of charge. Ten bars equals 100% state of charge. The display provides visual warnings when the battery charge reaches 20% (2 bars) and audible warnings when the charge reaches 10% (1 bar). Seek a 120 Volt AC power source when the system reaches 20%.



Powering Up the System

The EV system may be turned ON in two ways, either by plugging the vehicle into a 120 volt AC power source or by depressing the power switch on the battery.

Powering up the system by way of the AC Powered Battery Charger

- Locate the black AC power port plug on the passenger side of the vehicle. It is located halfway down the chassis in place of the fuel cap on a conventional gas powered vehicle.

AC Charger Port Plug

- Lift the rubber cap to expose a standard 15 amp power plug socket.
- Insert a common extension cord that can carry 15 amps and 120 volts AC into the power port.
- The system will wake up and light up the ten segment display on the dash.
- The display will show that it is charging by an increasing sequence of the display bars. lighting up from the current state of charge to the maximum of 10 bars. This process will continue to cycle until the display shows a solid display of ten bars.
- Let the system charge until 100% charge (10 bars) is achieved.
- Unplug when finished and the vehicle is ready for operation.
- Reinstall the rubber cap over the AC power port.

Note: Anytime the vehicle is plugged into AC Power, you cannot power down the battery with the push switch.

Powering up the system by way of the AC Powered Battery Charger

- Lift the driver seat.
- Locate the circular silver push switch on the side of the battery between the power cables. The power switch is labeled as MAIN SWITCH.

Battery Switch located on the side of the battery

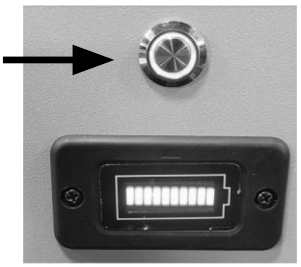
- To turn the battery on, press and hold the silver push switch for at least 5 seconds or until you hear the dash display beep and see it light up. Release the switch.
- Close the seat and the vehicle is ready for operation.

Powering down the vehicle by way of the battery switch

If the vehicle is not going to be used for more than a week, you should power off the battery.

- Lift the driver seat.
- Locate the circular silver push switch on the side of the battery between the power cables.
- To turn the battery off, press and hold the silver push switch for at least 5 seconds or until you see the dash display shut off. Release the switch.

Note: On Vehicles equipped with an extended range battery (160 Amp Hours), the vehicle may have a remote ON/OFF battery switch located above the battery state of charge meter on the dash. You may power up or power down the battery from this switch instead of raising the seat.



Operating the Vehicle

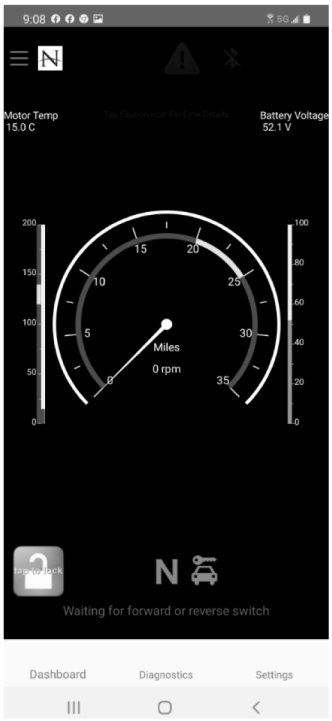
- Make sure that the battery is turned ON. The ten segment display on the
- dash shall be illuminated. Recharge the battery if the display shows 2 bars or less.
- While seated in the driver seat, turn the ignition key to the ON position.
- Connect your seat belt.
- Connect the side net to the receptacle.
- Release the Park Brake lever. Ensure the park brake light on the dash is OFF.
- Decide whether you want to operate in the MAX SPEED mode or the MAX RANGE mode. Push the upper portion of the switch to achieve maximum speed for the vehicle. The max speed is set by way of a programmable parameter. The factory default is 30 MPH or 24 MPH based upon vehicle application. Push the lower portion of the switch to achieve maximum distance with a limited speed of 12 MPH. This mode will provide the longest distance on a single charge.
- Rotate the gear selector switch to forward or reverse as you require. Maximum speed in Reverse is 6 MPH.
- Carefully depress the accelerator as you take off.

THEFT LOCK

The electric vehicle may be locked by way of a Bluetooth smart phone application. It is in the Android or Apple App Store as Navitas Vehicle Systems Ltd. Load up the application on your phone. No logon or password is required for basic usage.

Locking the vehicle

- Leave the ignition key in the ON position.
- Open the Navitas application
- Select your vehicle from the list.
- Bluetooth must be turned ON for this application to operate.
- Once connected, select the DASHBOARD screen.



- Locate the green UNLOCK ICON in the lower left corner of the screen.
- Depress the ICON once and it will turn red and show that the vehicle is locked.
- Shut the ignition key OFF.
- The vehicle will not move, even with key ON, while locked.

Unlocking the vehicle

- Turn the ignition key to the ON position.
- Open the Navitas application
- Select your vehicle from the list.
- Bluetooth must be turned ON for this application to operate.
- Once connected, select the DASHBOARD screen.

- Locate the red LOCK ICON in the center of the screen.
- Depress the ICON once and it will turn green to show that the vehicle is unlocked.
  The vehicle is now ready for normal operation.

BATTERY CHARGING

The lithium batteries need to be charged periodically just like previously used lead acid batteries. A built in on board charger on the vehicle provides a charging profile that is matched with these lithium batteries. The customer connection for powering up the charger is the AC power port on the passenger side of the vehicle.

- Locate the black AC power port plug on the passenger side of the vehicle. It is located halfway down the chassis in place of the fuel cap on a conventional gas powered vehicle.
- Lift the rubber cap to expose a standard 15 amp power plug socket.
- Insert a common extension cord that can carry 15 amps and 120 volts AC into the power port.
- The display will show that it is charging by an increasing sequence of display bars lighting up from the current state of charge to the maximum of 10 bars. This process will continue to cycle until the display shows a solid display of ten bars.
- Let the system charge until 100% charge (10 bars) is achieved.

AC Charging Port

Power Cord Plugged Into the AC Port

Charging Times assuming a completely discharged battery

- The smaller 105 Amp Hour battery will require approximately 5 hours to achieve a 100% state of charge.
- The larger 160 amp hour battery will require approximately 8 hours to achieve a 100% state of charge.

Charging Times assuming a completely discharged battery

The Lithium batteries provide a Quick Charge feature. The Quick Charge times provide an 80% charge if the batteries are totally discharged. If you do not need the mileage range described with a 100% charge, you can get an 80% charge in a much shorter time frame. The smaller 105 Amp hour battery can achieve an 80% charge in two hours. The larger 160 amp hour battery can achieve an 80% charge in three hours.

MILEAGE

The mileage that is achievable with the new American Landmaster Electric Vehicle is far superior to legacy models with lead acid batteries. No specific mileage range can be guaranteed since there are so many factors that can reduce or increase mileage ranges. Some of that factors that affect the mileage are:

1. Vehicle Speed
2. Acceleration
3. Outside Temperature
4. Cargo Load on the vehicle
5. Power Steering usage on the vehicle
6. Elevation of the drive, i.e. flat land versus hills
7. Driving behavior, i.e. aggressive versus conservative
8. State of charge at the beginning of the trip

The following information is provided based upon American Landmaster testing on warm days above 70 degrees F on flat roads. Note the effects of road speed and acceleration. All driving tests were performed with a full speed continuous run as much as possible. One driver with no cargo load in the bed.

Mileage Estimates:

105 amp hour battery, MAX Distance @ 12 MPH limit, 50% acceleration: 45 miles, 3.5 hours of drive time
105 amp hour battery, MAX SPEED @ 30 MPH limit, 100% acceleration: 25 miles, 1 hour of drive time
160 amp hour battery, MAX Distance @12 MPH limit, 50% acceleration: 70 miles, 6 hours of drive time
160 amp hour battery, MAX SPEED @ 30 MPH limit, 100% acceleration: 46 miles, 1.5 hours of drive time

Note: This performance data is offered for comparison purposes only and is no guarantee of mileage that will be achieved in your application. Be advised that colder temperatures will decrease your mileage. Reduction of 20 to 30 degrees F below 65 degrees can reduce mileage by 10 to 20%. Heavy cargo loads will reduce your mileage range.

DO'S & DON'TS

Do's:

1. Keep the battery charged often. The lithium batteries are allowed to be deeply discharged, but keep them topped off for your own convenience. Be sure to fully charge the battery if the vehicle will be stored for more than 30 days.

2. Turn the battery off with the push switch when the vehicle is not going to be used for more than seven days. This prevents slow discharging of the battery.

3. Wash the vehicle as required. Keep mud and trail debris from caking on the electric motor and battery connections.

4. Keep the tires inflated to 20 PSI. This will increase your mileage range.

Don'ts:

1. Don't operate the vehicle with outside temperatures below -4 degrees F. The lithium battery capacity will be greatly reduced.

2. Do not charge the battery when the vehicle has been stored in temperatures less than 32 degrees F. If the vehicle has been stored in colder conditions, move the vehicle to a warmer environment and let the vehicle stabilize at a temperature greater than 32 degrees before charging.

3. Do not drive through water sources that will submerge the electric motor.

4. Do not operate the vehicle or charger in a flammable environment.

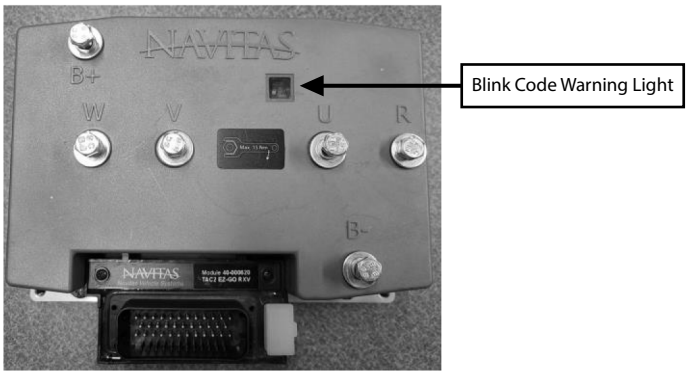
section 2 ev troubleshooting

ELECTRIC VEHICLE TROUBLESHOOTING

Troubleshooting and diagnosing the American Landmaster Electric vehicle is straightforward and is guided by a tiered diagnostic approach. This means that this guide shall provide top down troubleshooting instructions, starting at the highest level of general actions and drilling down to more detailed diagnostic measures.

The two major areas for diagnosis are the Navitas motor and controller system and the on board battery charger. Both have built in diagnostics and provide a means to display test results to the operator.

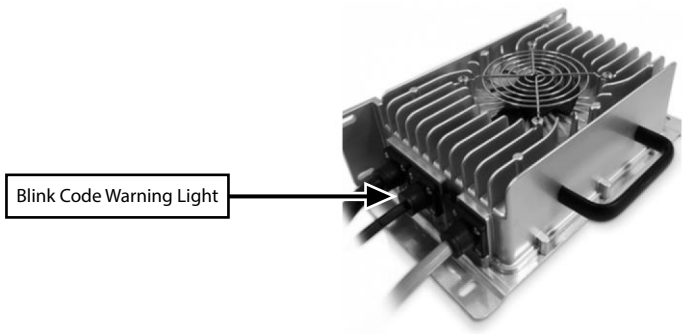
The electric motor and controller system by Navitas provides two methods of diagnostics. A single warning light that is visible through the top of the controller housing shall provide blink codes to describe various failure modes. The blink codes are presented as two digits and display a short pause between the first and second digit. A much longer pause is provided between multiple fault codes. The blink codes are provided in a repeating pattern, meaning that whether there is one or multiple active blink codes, the patterns will continue to display in a circular fashion as long as the key is on and the codes are active.



Navitas Motor Controller with Blink Code Light

The second method to display diagnostics with the Navitas System is through a Smart Phone Application which shall be described in detail later in this document. All vehicle owners may download this application for free from their APP Store onto their phone or tablet. It communicates with the Navitas System with a Bluetooth Interface. This is the most intuitive and effective method to diagnose the vehicle.

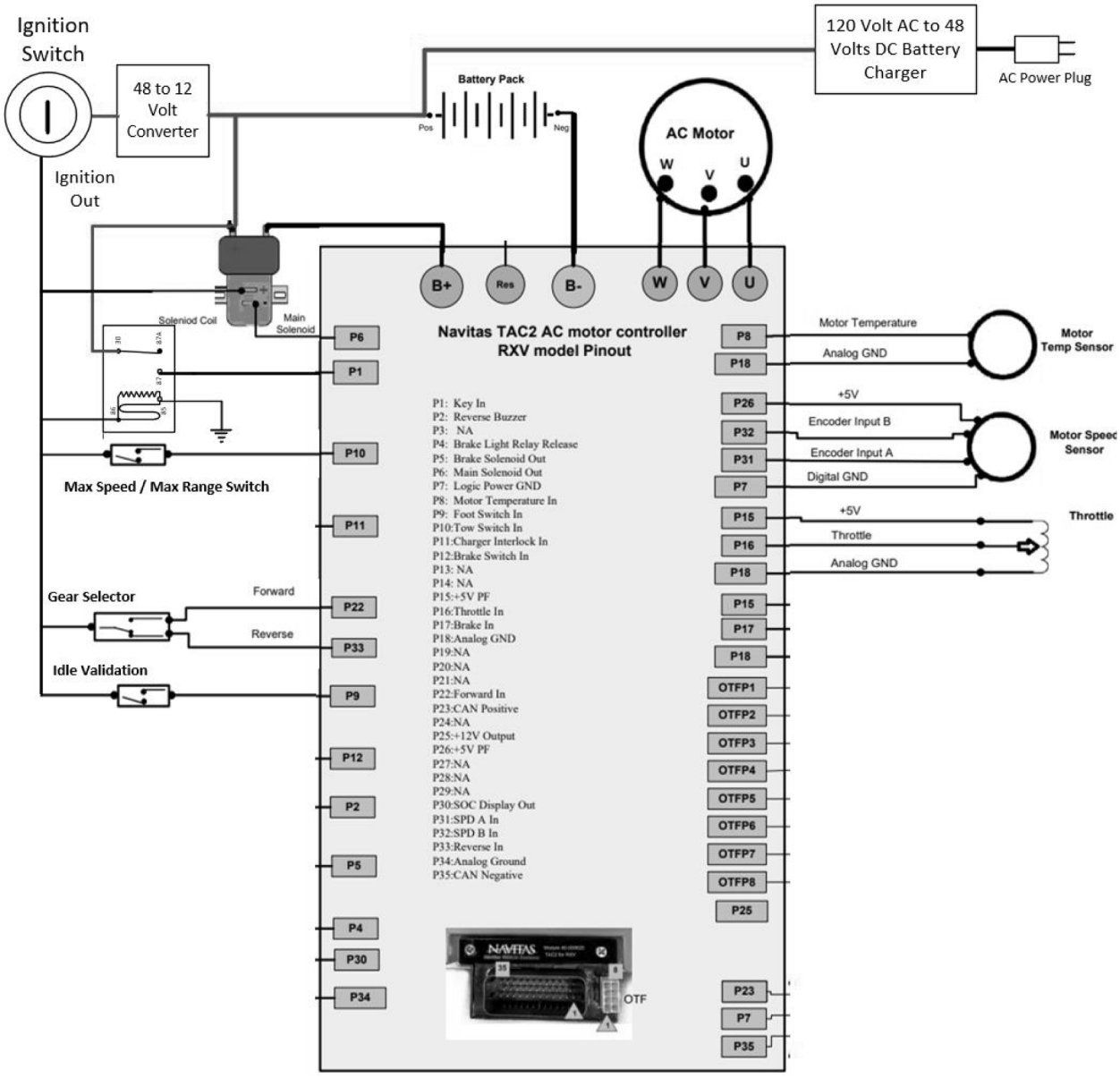
The second section to diagnose is the on board battery charger. It provides internal diagnostic results by way of an external blink code warning light. All blink codes are described later in this document.



On Board Charger

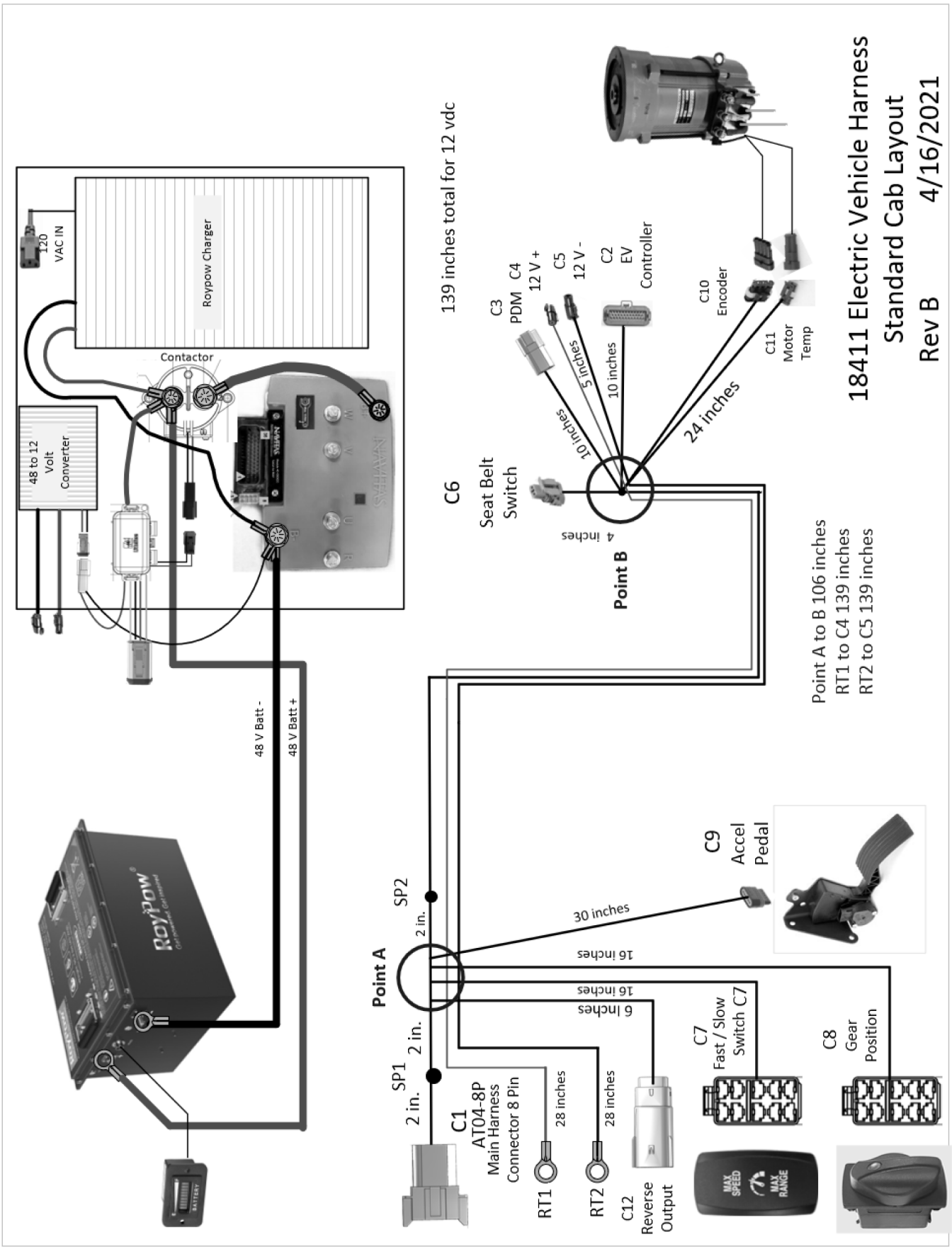
Instructional Information:

The following pages are provided to educate the user with the overall Electric Vehicle System. First a vehicle mechanization drawing is provided to show the major components of the electric vehicle. This does not show all connectors and harness partitioning, but does show how the system is assembled functionally. You can see the system is fairly simple with just a few interface signals.

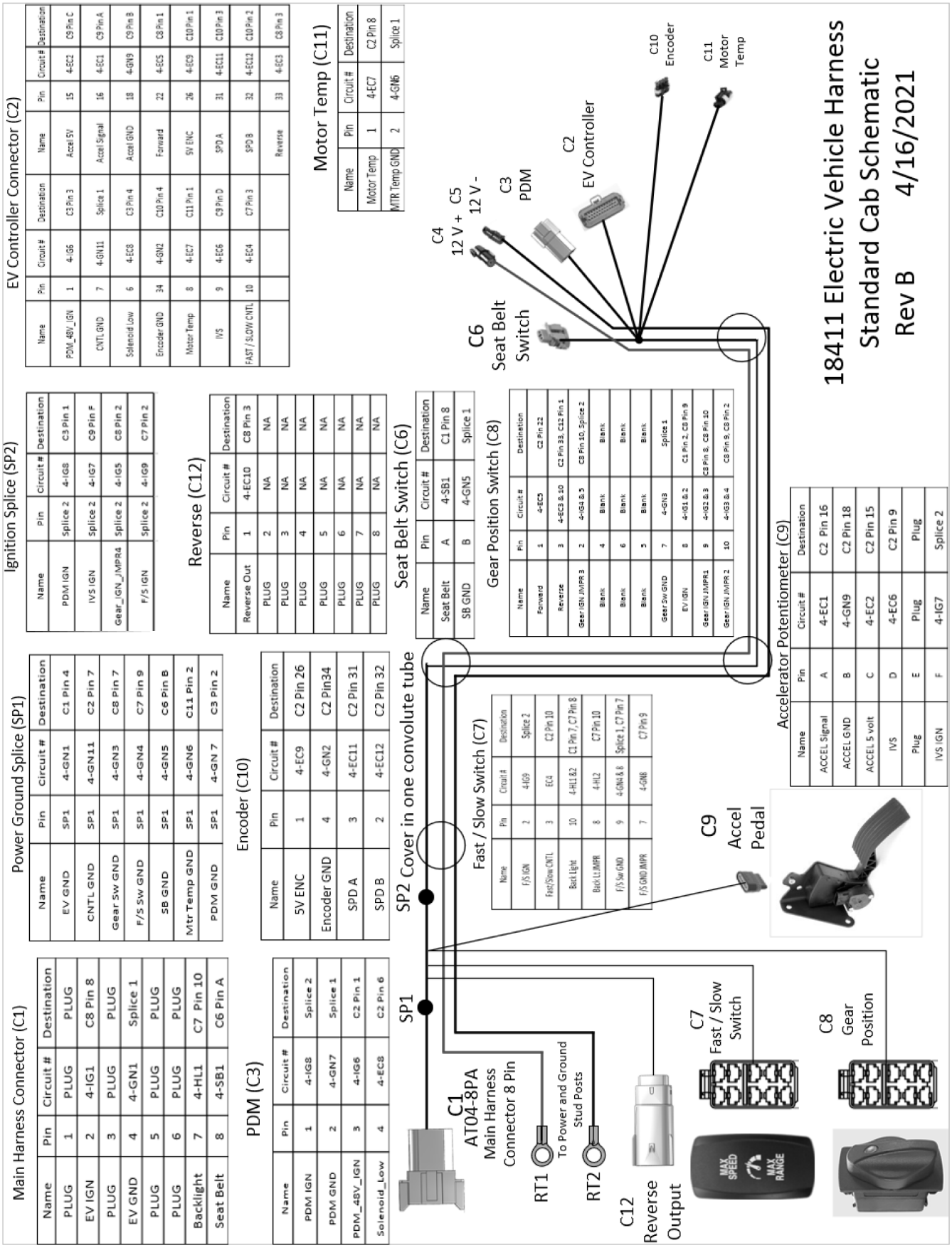


Electric Vehicle Mechanization Drawing

Next a system diagram is provided to show all connections and components. After that, detailed schematics are provided for specific circuit tracing, if needed. The schematics are “table based” which shows source and destination for each wire in the harnesses. Each connector has a reference designator like C1, C2, etc. and a small table to show key information about that connector. It includes the pin number, a wire name, a circuit number and a destination for the other end of the wire. There is a major EV chassis harness and a minor fuse and relay box harness to make up the system.



Battery Switch located on the side of the battery



Name	Pin	Circuit #	Destination
PLUG	1	PLUG	PLUG
EV IGN	2	4-IG1	C8 Pin 8
PLUG	3	PLUG	PLUG
EV GND	4	4-GN1	Splice 1
PLUG	5	PLUG	PLUG
PLUG	6	PLUG	PLUG
Backlight	7	4-HL1	C7 Pin 10
Seat Belt	8	4-SB1	C6 Pin A

Name	Pin	Circuit #	Destination
EV GND	SP1	4-GN1	C1 Pin 4
CNTL GND	SP1	4-GN11	C2 Pin 7
Gear Sw GND	SP1	4-GN3	C8 Pin 7
F/S Sw GND	SP1	4-GN4	C7 Pin 9
SB GND	SP1	4-GN5	C6 Pin B
Mtr Temp GND	SP1	4-GN6	C11 Pin 2
PDM GND	SP1	4-GN 7	C3 Pin 2

Name	Pin	Circuit #	Destination
PDM IGN	Splice 2	4-IG8	C3 Pin 1
IVS IGN	Splice 2	4-IG7	C9 Pin F
Gear_IGN_JMPR4	Splice 2	4-IG5	C8 Pin 2
F/S IGN	Splice 2	4-IG9	C7 Pin 2

Name	Pin	Circuit #	Destination
PDM_48V_IGN	1	4-IG6	C3 Pin 3
CNTL GND	7	4-GN11	Splice 1
Solenoid Low	6	4-EC8	C3 Pin 4
Encoder GND	34	4-GN2	C10 Pin 4
Motor Temp	8	4-EC7	C11 Pin 1
IVS	9	4-EC6	C9 Pin D
FAST / SLOW CNTL	10	4-EC4	C7 Pin 3

Name	Pin	Circuit #	Destination
Accel 5V	15	4-EC2	C9 Pin C
Accel Signal	16	4-EC1	C9 Pin A
Accel GND	18	4-GN9	C9 Pin B
Forward	22	4-EC5	C8 Pin 1
5V ENC	26	4-EC9	C10 Pin 1
SPD A	31	4-EC11	C10 Pin 3
SPD B	32	4-EC12	C10 Pin 2
Reverse	33	4-EC3	C8 Pin 3

Name	Pin	Circuit #	Destination
Motor Temp	1	4-EC7	C2 Pin 8
MTR Temp GND	2	4-GN6	Splice 1

Name	Pin	Circuit #	Destination
Reverse Out	1	4-EC10	C8 Pin 3
PLUG	2	NA	NA
PLUG	3	NA	NA
PLUG	4	NA	NA
PLUG	5	NA	NA
PLUG	6	NA	NA
PLUG	7	NA	NA
PLUG	8	NA	NA

Name	Pin	Circuit #	Destination
Seat Belt	A	4-SB1	C1 Pin 8
SB GND	B	4-GN5	Splice 1

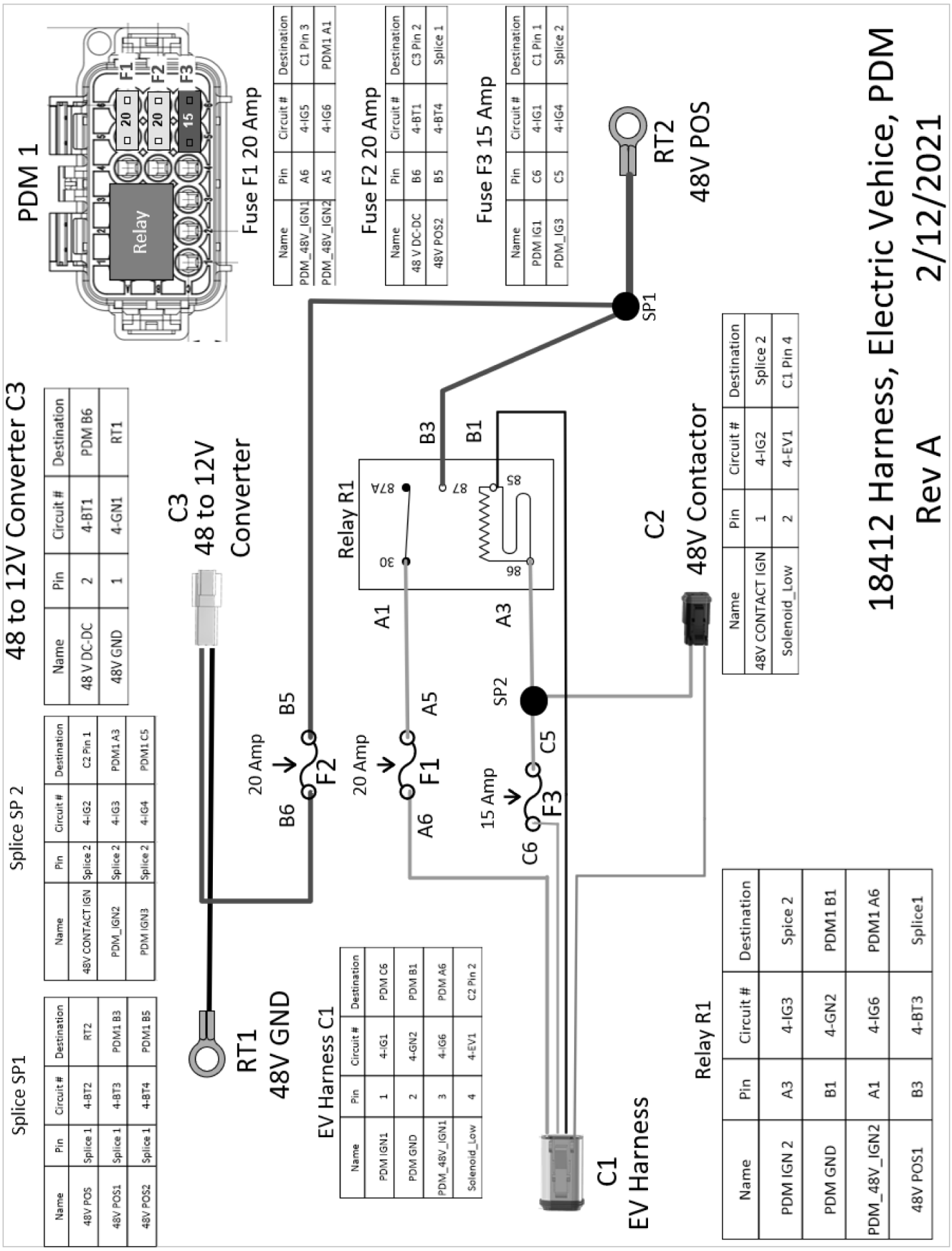
Name	Pin	Circuit #	Destination
Forward	1	4-EC5	C2 Pin 22
Reverse	3	4-EC3 & 10	C2 Pin 33, C12 Pin 1
Gear IGN JMPR 3	2	4-IG4 & 5	C8 Pin 10, Splice 2
Blank	4	Blank	Blank
Blank	6	Blank	Blank
Blank	5	Blank	Blank
Gear Sw GND	7	4-GN3	Splice 1
EV IGN	8	4-IG1 & 2	C1 Pin 2, C8 Pin 9
Gear IGN JMPR1	9	4-IG2 & 3	C8 Pin 8, C8 Pin 10
Gear IGN JMPR 2	10	4-IG3 & 4	C8 Pin 9, C8 Pin 2

Name	Pin	Circuit #	Destination
5V ENC	1	4-EC9	C2 Pin 26
Encoder GND	4	4-GN2	C2 Pin34
SPD A	3	4-EC11	C2 Pin 31
SPD B	2	4-EC12	C2 Pin 32

Name	Pin	Circuit #	Destination
PDM IGN	1	4-IG8	Splice 2
PDM GND	2	4-GN7	Splice 1
PDM_48V_IGN	3	4-IG6	C2 Pin 1
Solenoid_Low	4	4-EC8	C2 Pin 6

Name	Pin	Circuit #	Destination
F/S IGN	2	4-IG9	Splice 2
Fast/Slow CNTL	3	EC4	C2 Pin 10
Back Light	10	4-HL1 &2	C1 Pin 7, C7 Pin 8
Back Lt JMPR	8	4-HL2	C7 Pin 10
F/S Sw GND	9	4-GN4 & 8	Splice 1, C7 Pin 7
F/S GND JMPR	7	4-GN8	C7 Pin 9

Name	Pin	Circuit #	Destination
ACCEL Signal	A	4-EC1	C2 Pin 16
ACCEL GND	B	4-GN9	C2 Pin 18
ACCEL 5 volt	C	4-EC2	C2 Pin 15
IVS	D	4-EC6	C2 Pin 9
Plug	E	Plug	Plug
IVS IGN	F	4-IG7	Splice 2



Name	Pin	Circuit #	Destination
PDM_48V_IGN1	A6	4-IG5	C1 Pin 3
PDM_48V_IGN2	A5	4-IG6	PDM1 A1

Name	Pin	Circuit #	Destination
48 V DC-DC	B6	4-BT1	C3 Pin 2
48V POS2	B5	4-BT4	Splice 1

Name	Pin	Circuit #	Destination
PDM IG1	C6	4-IG1	C1 Pin 1
PDM_IG3	C5	4-IG4	Splice 2

Name	Pin	Circuit #	Destination
48V CONTACT IGN	1	4-IG2	Splice 2
Solenoid_Low	2	4-EV1	C1 Pin 4

Name	Pin	Circuit #	Destination
48 V DC-DC	2	4-BT1	PDM B6
48V GND	1	4-GN1	RT1

Name	Pin	Circuit #	Destination
48V CONTACT IGN	Splice 2	4-IG2	C2 Pin 1
PDM_IGN2	Splice 2	4-IG3	PDM1 A3
PDM IGN3	Splice 2	4-IG4	PDM1 C5

Name	Pin	Circuit #	Destination
48V POS	Splice 1	4-BT2	RT2
48V POS1	Splice 1	4-BT3	PDM1 B3
48V POS2	Splice 1	4-BT4	PDM1 B5

Name	Pin	Circuit #	Destination
PDM IGN1	1	4-IG1	PDM C6
PDM GND	2	4-GN2	PDM B1
PDM_48V_IGN1	3	4-IG6	PDM A6
Solenoid_Low	4	4-EV1	C2 Pin 2

Name	Pin	Circuit #	Destination
PDM IGN 2	A3	4-IG3	Spice 2
PDM GND	B1	4-GN2	PDM1 B1
PDM_48V_IGN2	A1	4-IG6	PDM1 A6
48V POS1	B3	4-BT3	Splice1

Pre-checks Before Detailed Diagnostic Troubleshooting:

1. Ensure that the battery is fully charged. Battery meter should show all ten bars when fully charged. Use a voltmeter to verify that that voltage across the battery terminals is at least 51 Volts DC. If the battery will not charge, proceed to the Battery Charger Diagnostic section of this document.

2. Inspect all battery cables for a clean and tight connection. If corrosion is present, clean all cables and terminals and apply a layer of dielectric grease. Tighten all battery cables to 12 Newton meters. Use a torque wrench; do not guess. Snapping off a battery terminal will require complete replacement of the battery at your expense.

3. Do a visual inspection of the entire vehicle electrical system. Have any of the harnesses or components been damaged by trail debris or animal chewing such as from squirrels or chipmunks? Repair as necessary.

Diagnostic Tests:

The following diagnostic procedures are presented in a table approach with a first action, second action and third action approach. It is assumed that the technician has basic electrical troubleshooting skills and is equipped with fundamental tools like a volt / Ohmeter for troubleshooting electrical systems.

1. Unit is totally inoperative: No power with key on.

There are many reasons why an electric vehicle may be inoperative. This first section walks you through troubleshooting the basic power distribution system for the 48 volt and the 12 volt system. The Navistas motor and controller system runs from 48 volts, but most of the input controls are 12 volt activated. One exception to note is that the main logic power to the controller must be 48 volts as evidenced by the inclusion of a relay in the small fuse / relay box in the module tray.

Problem	First Action	Second Action	Third Action
Vehicle Is Inoperative with Key ON	Verify that the Battery is ON	Verify battery is not discharged. Voltage should be above 46 volts as measured with a DC voltmeter at the main battery terminals.	If 48 volt system is up and running, verify that the 12 volt system is functional. Will the headlights come on with key ON? Does the voltmeter in the dash display 12 volts? If no perform next step.
	Push and hold the battery switch for 5 seconds	If the battery volts are less than 46 volts, plug in the charger until fully charged. Plugging in the charger should automatically turn the battery and the battery meter ON.	Verify that 48 volts is present on the gray two pin connector feeding the DC to DC converter. If no, then check the fuse F2 in the fuse box located in the module tray. If blown, replace the fuse. Verify that the fuse does not blow again. If it does, disconnect the DC to DC converter and verify that the 48 volts is present with a new fuse. If the fuse blows again when the DC to DC module is hooked up, replace the DC to DC converter module. If the system operates, you are done. If the 48 volts are present and the 12 volt system will not come up after replacing the 48 to 12 volt converter, proceed to the next step.
	Battery Meter should light up and beep once. If yes, proceed to the next step. If no, proceed to the Second Action.	Battery meter should light up when the charger is plugged in. If yes, go to the next Step. If No, go to the Charger Diagnostic Section.	Disconnect the two one way Deutsch connectors on the DC to DC converter and verify that the output is 12 volts +/- .5 volts. If there is no output, replace the DC to DC converter.
	Verify that the head lights operate with key ON. If yes and the vehicle will not operate then proceed to the Navitas Diagnostic Section. If no, proceed to the Third Action.	Verify that the head lights operate with the key ON. If Yes, system power is up and running. If the batteries are fully charged, the 12 vot system is operational and the vehicle still will not run, proceed to the Naviats Diagnostic Section of this document. If no, then proceed to the Third Action.	If the 12 volt output goes to zero when the converter is hooked up to the vehicle harness, then check the power and ground 10 gauge wires that are routed up to the jump start stud component in the front of the vehicle and look for a short to ground. Check for pinched or chaffed wires along the routing path. Repair wires as required.
			If problem persists, call American Landmaster Customer Service
			Caution: Never hook a 12 volt battery charging source to the jump start studs on the vehicle. This action will permanently damage the 48 to 12 volt converter module.
		Note: The 48 volt ground and the 12 volt ground circuits are isolated for safety. Therefore, when measuring 48 volt circuits the ground lead of the voltmeter must be connected to the Ground stud of the Navitas controller. 12 volt circuits must be measured with the voltmeter ground connected to a clean spot on the frame or the ground side of the jump start stud.	Note: The 48 to 12 volt converter module has internal short circuit protection. Once shorted you must remove the 48 volt input with the gray two pin connector to allow the module to reset. Re-apply 48 volts and verify that the 12 volt output returns.

2. Battery Charger Diagnostics.

The following table describes the steps to troubleshoot the battery charging system. The charger is intelligent and provides a series of blink codes to identify various failure modes. Common sense diagnostics must still be employed first to verify that you have AC power from you facility and that your power cord is functional. Please follow these action steps.

Problem	First Action	Second Action	Third Action
Vehicle will not take a charge	Verify AC Power is being supplied to the charger. Verify that 120 Volt AC power is present at the end of your extension cord. Connect to the AC power port on the side of the vehicle. Go to next step if the problem persists.		
	Remove the cover from the module tray behind the driver seat and verify that the indicator on the side of the charger with the power cable plugged in is either blinking or ON solid in a green color with AC power applied. If yes, the charger is functioning correctly. If NO proceed to the next steps and verify if a blink code exists as shown below.	Verify that there is at least 52 volts DC present at the charger output by tapping on to the ground stud of the controller and the positive connecion at the input to the contactor with a voltmeter. The charger will provide about 58 volts near the end of the charge cycle.	
	If the charger indicator is blinking red quickly, then input AC power is missing. Verify that the charger AC plug is connected to the AC Power port plug. Verify ther is no corrosion at this connection.	Is there any damage to the AC charger port ins on the side of the vehicle. If yes, replace the AC charger port cable.	
	If the indicator blinks red and green in an alternating pattern then the output is shorted or the charger output cables are reversed. Note: This pattern may appear for a few seconds when power is first applied so wait for 15 seconds before making this check.	If there is no voltage at the output of the charger, then disconnect the postive output wire of charger and cycle AC power off and then back on again. Is the charger output being overloaded? If the charger still has no output when the output is disconnected and AC power is applied, replace the charger.	If charger voltage returns while the output is disconnected, then check for pinched or chaffed wires on the 48 volt battery leads. Repair or replace as required.
	If the indicator blinks red twice followed by a 1 second pause then repeats the sequence, the charger in in an over temperature condition.	Over temperature shutdown should not occurr with this vehicle. However, if it does, move the vehicle to a cooler location before charging the battery.	
	If the indicator blinks red three times followed by a 1 second pause then repeats the sequence, the charger in in an over current condition.	If there is no voltage at the output of the charger, then disconnect the postive output wire of charger and cycle AC power off and then back on again. Is the charger output being overloaded? If the charger still has no output when the output is disconnected and AC power is applied, replace the charger.	If charger voltage returns while the output is disconnected, then check for pinched or chaffed wires on the 48 volt battery leads. Repair or replace as required.
	If the indicator blinks red four times followed by a 1 second pause then repeats the sequence, the charger in in an over voltage condition.	Over voltage shutdown should not occurr with this vehicle. However, if it does, call American Landmster Customer Service.	
	Note: If the battery is fully charged, the charger will shut off and display a solid green light on the blink code light when AC power is applied.		

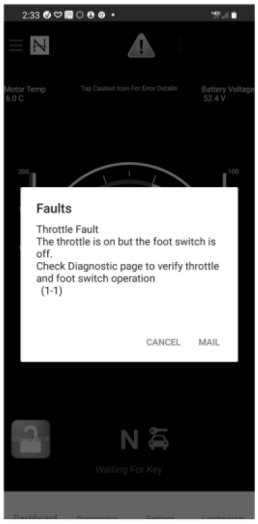
3. Navitas Motor and Controller Systems Diagnostics.

Troubleshooting the motor and controller system is aided by two methods of fault reporting. The system provides a single red warning light that is visible through the front face of the motor controller which is located in a module tray behind the driver. This light is used to display fault codes through blink codes. If the system is functioning correctly, the fault code light will be off with the ignition key ON. Blink codes may be decoded by looking up the pattern in the following table. In addition, the system provides a way to see the fault codes by viewing them on a smart phone application. The Application may be down loaded by any user through either an Android or Apple APP Store. The application is titled Navitas Vehicle Systems Ltd. Down load this APP and open. No logon or password is required. This is a powerful software tool that communicates with the Navitas System with the Bluetooth Interface in your phone. Make sure your Bluetooth interface is enabled.

The tool is divided into three screens. The first one is a Dashboard screen which shows a speedometer, a motor temperature display and a battery level meter. It also supplies a few icons along the bottom to show the gear position, the ignition key status and the System Lock icon control. The second screen is a Diagnostic screen to allow the user to view the status of key signals in real time. The third screen is dedicated to programmable parameters. As an end user, you will have a limited access to just a few selections like tire size and top speed limit. We suggest that you do not make adjustments to any of these parameters. The following tables are provided by Navitas and contains a listing of all possible fault codes for the system. Since many of the inputs and outputs of the Navitas System are not used by the American Landmaster design, many of these fault codes will never be present. You can see fault codes directly from the application by looking at the Dashboard Screen with the ignition key ON. If there is an active fault code in the system, you will see a yellow triangle illuminated at the top of the screen as shown below. When you tap on the yellow triangle, a dialog box will pop up to show you the fault code.

See the sample below that displays when the accelerator pedal is disconnected. It is fault code 1-1. This code will also be displayed as a blink code on the motor controller module face.

Active Fault Code Shown with Yellow Triangle



Fault Code Revealed by Tapping on the Triangle

If you have an active fault code in your system, look it up in the following table and use the other resources like schematics, harness layouts and the diagnostic screen to aid you in determining root cause. Those fault codes that are not applicable to the American Landmaster System have been marked out.
Note: When diagnosing the Max Speed and Max Range switch, be advised that the pin used for this feature has been assigned to the RUN / TOW switch input which is pin 10 on the 35 pin controller connector.

* Check the 'Caution' icon on app first for fault descriptions or refer to the chart below

FLASH CODES	FLASH CODE MESSAGE	DESCRIPTION	SOLUTION	HOW TO CHECK
1-1	**Throttle Fault**	The foot switch is not engaged and the throttle signal voltage is above minimum throttle parameter. This indicates the foot switch is not coming on or the throttle has broken where its off voltage is to high	• Check wiring • Replace throttle	• The diagnostic page of the App will give you readings for the throttle voltage and foot switch. • Put the vehicle in neutral and slowly depress the throttle. • The foot switch should change from **Off** to **On** before the throttle voltage reaches around 1V. • Standard throttles usually read 0.5V when off. The minimum voltage to start the vehicle is usually 1V. The maximum when depressed should read around 4V.
1-2	**Brake Fault**	The analog brake signal is higher than the high voltage installed on certain types of vehicles such as RXV's.	• Check wiring • Replace brake switch	• The diagnostic page of the App will give you readings for the brake voltage neutral and brake. rakes usually f. The minimum vehicle is usually 1V. The maximum when depressed should read around 3V to 4V
1-3	**Charger Interlock**	Charger is connected and the vehicle is not in neutral. On Board Computer (OBC) is in sleep mode.	• Disconnect the Charger before trying to move. • Depress the throttle twice to wake up OBC. • Replace charger port on vehicle	• The diagnostic page of the App will give you readings for the charger input connected signal. ut will read s no charger
1-4	**Temperature (Controller)**	Performance is limited because the controller is hot.	• Let vehicle cool off, system is over worked.	Check the temperature of the controller with a non-contact temperature sensor
1 - 5	**Temperature (Motor)**	Performance is limited because the motor is hot.	• Let vehicle cool off, system is over worked.	• Check the temperature of the motor with a non-contact temperature sensor.

Not Applicable for American Landmaster

Not Applicable for American Landmaster

FLASH CODES	FLASH CODE MESSAGE	DESCRIPTION	SOLUTION	HOW TO CHECK
1 - 6	**Solenoid High Resistance**	Voltage across solenoid (battery side (logic power) to controller side measured (B+ terminal)) is greater than the hard coded 5V.	• Replace solenoid	• Test the solenoid by measuring ohms across the large terminals. • The error usually only occurs when drawing large currents (200A) through the solenoid. The solenoid may be under rated or oxidizing with ag
1 - 7	**Flash Memory Error**	Code updates from the App may force this error so cause the user to press the Initialize button and Save button.	• Press the Initialize button and Save button in the App.	• Contact dealer as they have a "Dealer/Technician" version of the App.
2 - 1	**Direction Switch Fault**	Both FWD & REV signal came on at the same time.	• Check and replace FWD & REV switch	• The diagnostic page of the App will give you readings for the Forward switch and Reverse switch • Check the Switch. Does the Switch feel the same when toggled from FWD to Neutral to REV? If so check continuity of the switch.
2 - 2	**Main Solenoid**	Voltage across solenoid (battery side to controller side measured B+ terminal) is greater than the hard coded 1V after solenoid has closed	• Confirm the solenoid is working properly. Change solenoid if required.	• Put vehicle in Neutral. Measure voltage on main terminals (high current connections) of the solenoid. Depress throttle and listen for solenoid to click. If solenoid clicks and the voltage does not drop to zero between the main terminals. Replace solenoid. • If solenoid does NOT click measure the voltage across the small terminals of the solenoid when the throttle is depressed. It should read the battery voltage. If it reads the battery voltage the solenoid is bad. If it does not read the battery voltage check vehicle wiring

FLASH CODES	FLASH CODE MESSAGE	DESCRIPTION	SOLUTION	HOW TO CHECK
2 - 3	**Controller not pre-charging**	Abnormally low voltage on the controller between B+ and B-.	• Clean and dry off the controller • Check voltage • Check all wires are connected to controller • **DO NOT replace the controller until all of the "How to Check" diagnostics regarding Flash Code 2 - 4 have been completed and the motor has been tested for short circuits!**	• The dashboard page of the App will give you readings for the battery voltage. • Visually check for debris or moisture on controller terminals and wires (There may be a short across the B+ and B- terminals). • Check the voltage between B+ and B- on the controller. It should equal the battery pack voltage. • Check that the wires are not damaged. • Check that no accessories (light kits, stereos, etc.) are using the frame as a ground. • Remove all cables except B- from the controller. • Tape cables so they do not touch each other or the vehicle frame. Controller harness should remain plugged into the controller. • Move Run/Tow switch to Run, turn on key switch, depress the throttle. If Flash Code 2-4 returns replace the controller. • Otherwise there is a wiring problem. Reconnect wires one at a time (turn off RUN/TOW switch each time) until Flash Code 2-4 returns. This will indicate where the wiring issue is located.
2 - 4	**Main Solenoid Current Fault**	Solenoid coil takes too much current.	• Check for loose wires or a short across small terminals on the solenoid. • Replace main solenoid.	• Check for loose wires. If there is a diode across the solenoid check that it is not shorted. • Test solenoid by measuring resistance across the small terminals of the solenoid. The resistance should be greater than 48 OHMS if it is a single coil solenoid and greater than 20 OHMS if it is a double coil solenoid.
2 - 5	**Parking Brake Solenoid (Connected to motor) Current Fault**	Solenoid coil takes too much current.	• Check for loose wires or a short across small terminals on the solenoid. • Replace main solenoid.	• Check for loose wires. If there is a diode across the solenoid check that it is not shorted. • Test solenoid by measuring resistance across the small terminals of the solenoid. The resistance should be greater than 48 OHMS if it is a single coil solenoid and greater than 20 OHMS if it is a double coil solenoid.

FLASH CODES	FLASH CODE MESSAGE	DESCRIPTION	SOLUTION	HOW TO CHECK
3 - 1	**Battery Under Voltage**	Batteries are empty or too low.	• Recharge batteries • Check for bad or damaged batteries. • Check battery cables are not loose or damaged. • Check solenoid	• Use a battery load tester to verify battery condition after charging. • Connect volt meter batteries. (Use alligator clips). Measure the voltage while driving to see if the voltage drops. • Connect Volt meter to the controller if the voltage drops at the controller and not at the battery then the solenoid may be bad.
3 - 2	**Battery Over Voltage**	Batteries are over charged or not excepting any more regenerative currents	• Check for bad or damaged Batteries. • Check Battery Cables are not loose or damaged. • Check Solenoid	• Use a battery load tester to verify battery condition after charging. • Connect volt meter batteries. (Use alligator clips). Measure the voltage while driving to see if the voltage rises. • Connect volt meter to the controller if the voltage rises at the controller and not at the battery then the solenoid may be bad.
3 - 3	**Motor Over Current**	Motor current has risen above the maximum motor current parameter.	• Check Motor U,V,W cables are not shorted to ground **See diode chart below**	• The diagnostics page of the App will give you readings for the U phase voltage, V phase voltage, W phase voltage • The phases should read around half the battery voltage. • Disconnect phases at controller and check readings again

NON-FLASH CODE ERRORS. Note: The list below shows some possible issues when the Controller does not show a Flash Code Error. These issues are mainly related to the Vehicle. Always check the Manufacturers Service Manual.

ISSUE	CAUSE	HOW TO CHECK
The Vehicle is moving slower than normal.	• Batteries are discharged • Bad or damaged motor • Faulty speed sensor • Faulty throttle • OTF programmer is locked at low speed	• Re-charge the batteries • Check brakes are releasing properly and vehicle is easy to push • Check motor • With the App verify throttle reaches maximum value • Connect the OTF programmer, unlock it and adjust to desired speed. Note: Lock OTF programmer before removing it or the settings may change.
Vehicle is shutting down	• Check vehicle wiring for loose connections • Check the OBC (On Board Computer)	• Check the OBC by referring to the "OBC section" in the manufacturer's service manual.
Vehicle feels sluggish after driving for a while.	• Battery cables are undersized	• Upgrade the power cables to recommended 4AWG
Faulty Controller	• Controller malfunction	• Use a digital multi-meter set to diode mode →| • Remove all wires and cables on controller • Use "Controller Diode Test" chart below to test the controller
Car Stutters	• Motor cables are not connected properly	• Check motor cables properly connected U-U< V-V, W-W • Check speed sensor wires not crossed.

Table 1 Controller Test Diode Chart

BLACK LEAD ⊖	RED LEAD ⊕	VOLTAGE →|
B+	U	0.42 V approx.
U	B-	0.42V approx.
B+	V	0.48V approx.
V	B-	0.48V approx.
B+	W	0.48V approx.
W	B-	0.48V approx.