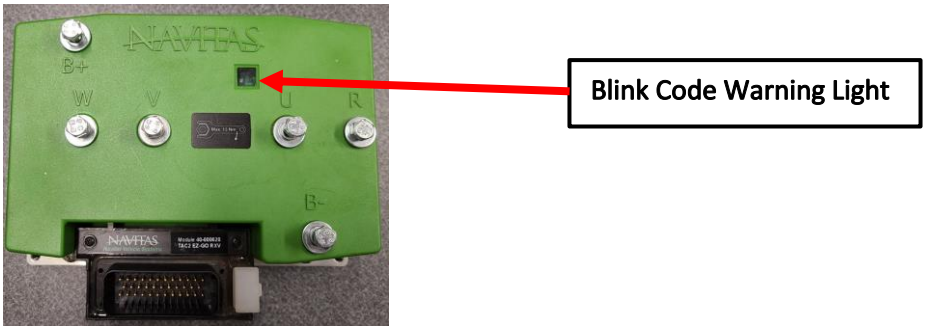
Electric Vehicle Troubleshooting Guide

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.

WARNING: BEFORE SERVICING ANY PART ON THE ELECTRIC VEHICLE, THE 48 VOLT BATTERY MUST BE SHUT OFF. PUSH AND HOLD THE SILVER BUTTON SWITCH ON THE SIDE OF THE BATTERY BY THE BATTERY CABLES FOR AT LEAST 5 SECONDS OR UNTIL THE BATTERY METER GOES OFF.

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.

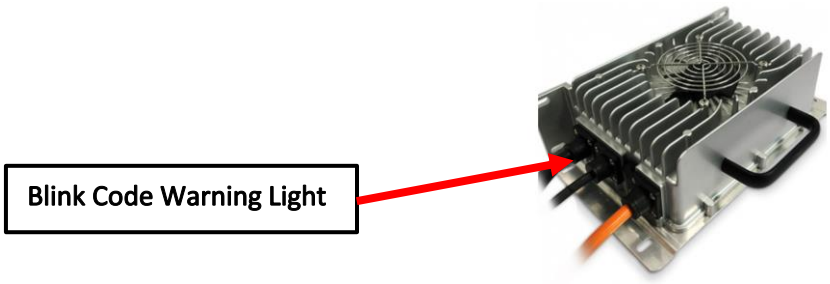
The electric motor and controller system by Navitas provides two methods of diagnostics. A single warning light that is visible through the top of the controller housing shall provide blink codes to describe various failure modes. The blink codes are presented as two digits and display a short pause 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 they 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.

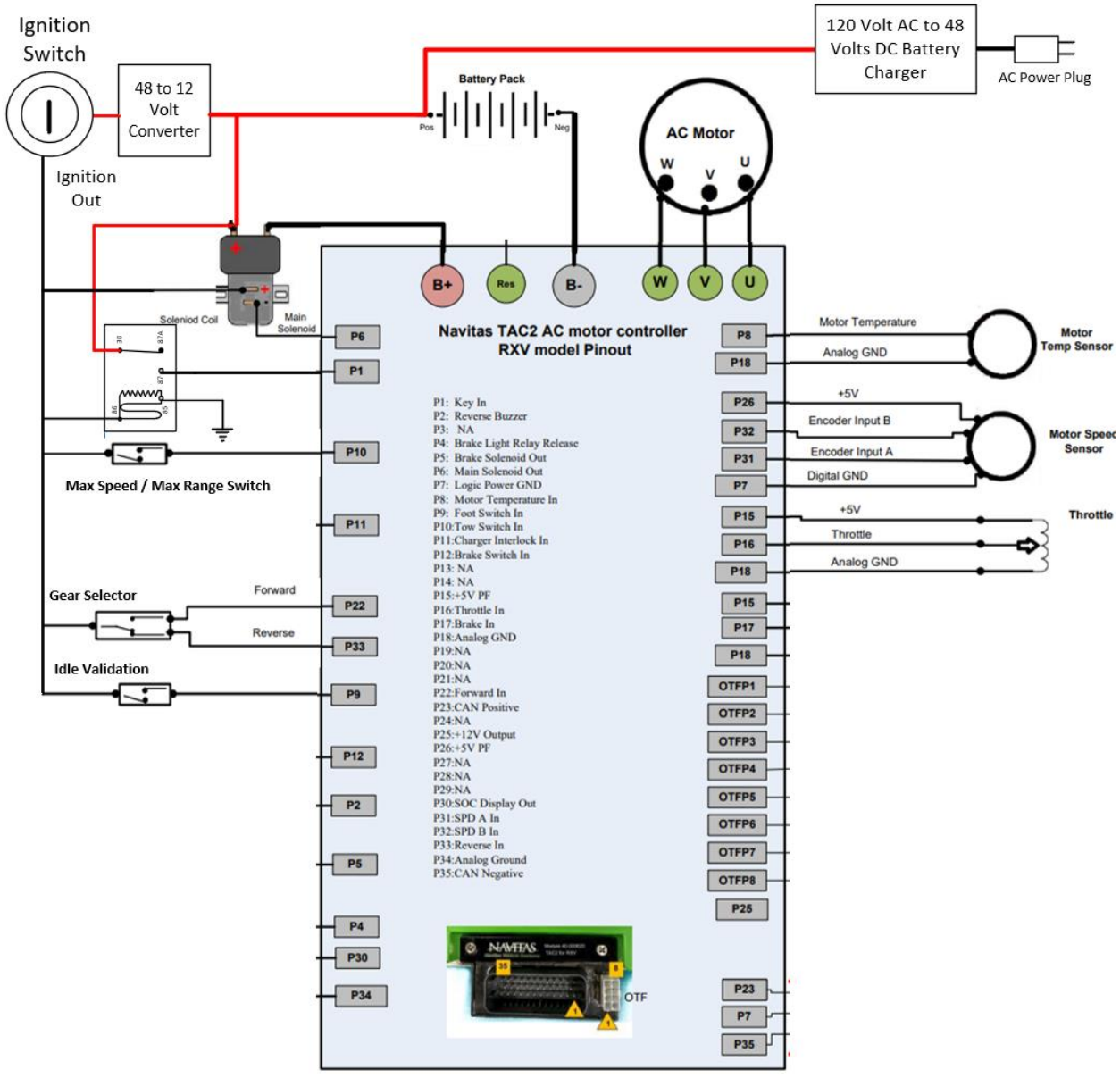
The second section to diagnose is the on board battery charger. It provide internal diagnostic results by way of an external blink code warning light. All blink codes are described later in this document.



On Board Charger

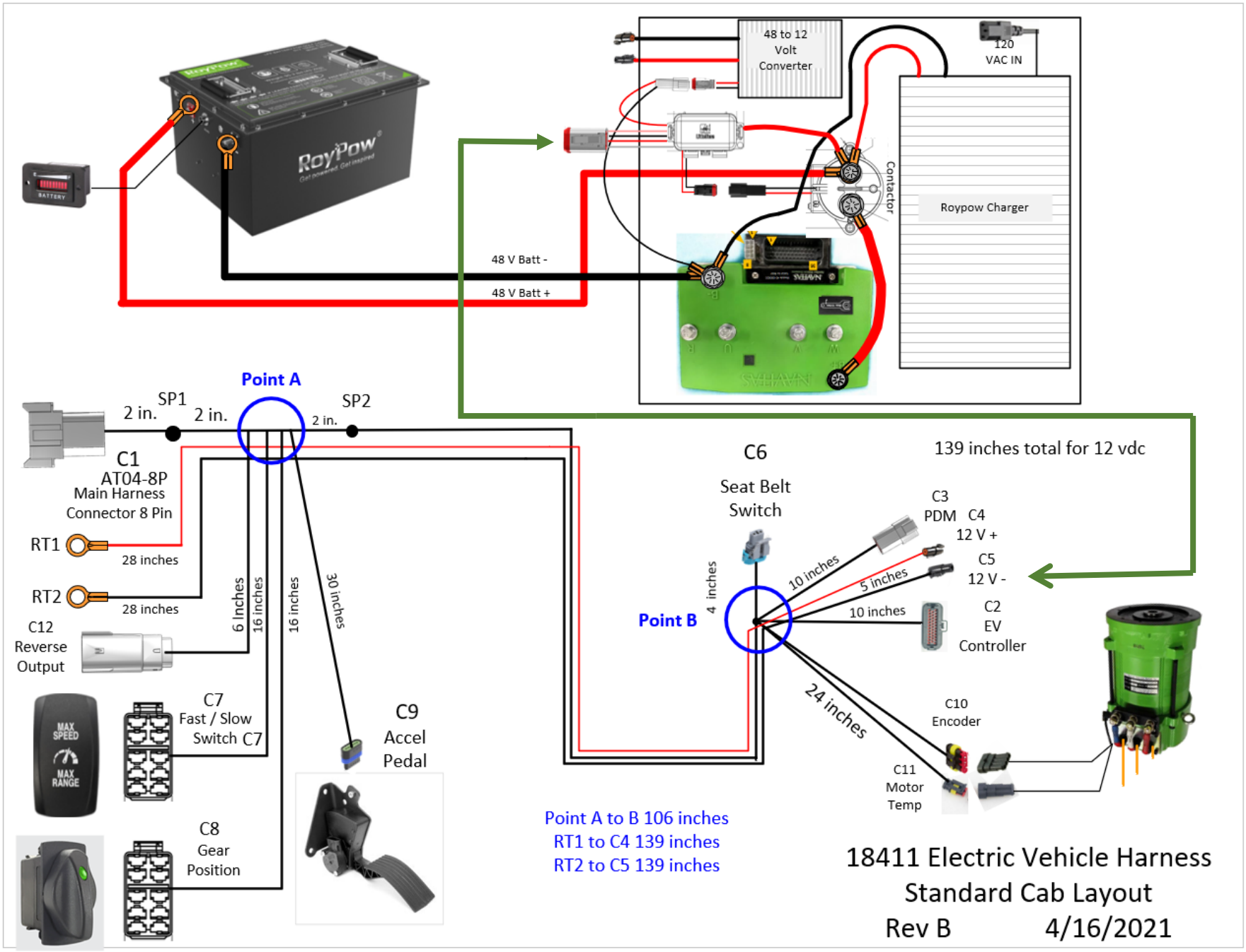
Instructional Information:

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.


48 to 12
Volt
Converter
120
VAC IN
Contactor
Roypow Charger
48 V Batt -
48 V Batt +
Point A
SP1
SP2
2 in.
2 in.
2 in.
C1
AT04-8P
Main Harness
Connector 8 Pin
RT1
28 inches
RT2
28 inches
C12
Reverse
Output
6 Inches
16 inches
16 inches
30 inches
C7
Fast / Slow
Switch C7
C8
Gear
Position
C9
Accel
Pedal
C6
Seat Belt
Switch
Point B
4 inches
10 inches
5 inches
10 inches
24 inches
C3
PDM
C4
12 V +
C5
12 V -
C2
EV
Controller
C10
Encoder
C11
Motor
Temp
139 inches total for 12 vdc
Point A to B 106 inches
RT1 to C4 139 inches
RT2 to C5 139 inches
18411 Electric Vehicle Harness
Standard Cab Layout
Rev B 4/16/2021

Main Harness Connector (C1)

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

Power Ground Splice (SP1)

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

Ignition Splice (SP2)

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

EV Controller Connector (C2)

Name	Pin	Circuit #	Destination	Name	Pin	Circuit #	Destination
PDM_48V_IGN	1	4-IG6	C3 Pin 3	Accel 5V	15	4-EC2	C9 Pin C
CNTL GND	7	4-GN11	Splice 1	Accel Signal	16	4-EC1	C9 Pin A
Solenoid Low	6	4-EC8	C3 Pin 4	Accel GND	18	4-GN9	C9 Pin B
Encoder GND	34	4-GN2	C10 Pin 4	Forward	22	4-EC5	C8 Pin 1
Motor Temp	8	4-EC7	C11 Pin 1	5V ENC	26	4-EC9	C10 Pin 1
IVS	9	4-EC6	C9 Pin D	SPD A	31	4-EC11	C10 Pin 3
FAST / SLOW CNTL	10	4-EC4	C7 Pin 3	SPD B	32	4-EC12	C10 Pin 2
				Reverse	33	4-EC3	C8 Pin 3

PDM (C3)

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

Encoder (C10)

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

Reverse (C12)

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

Motor Temp (C11)

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

Seat Belt Switch (C6)

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

Fast / Slow Switch (C7)

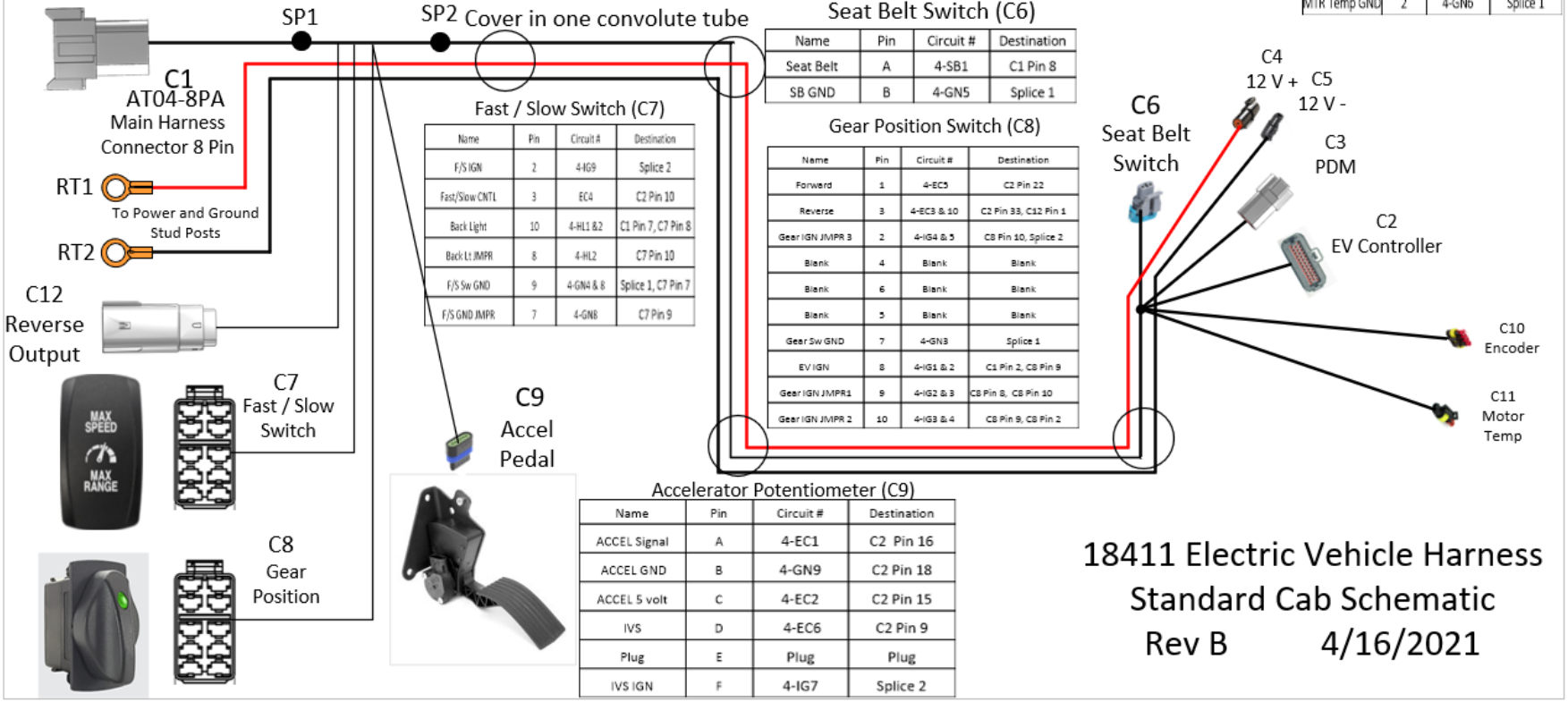
Name	Pin	Circuit #	Destination
F/S IGN	2	4-IG9	Splice 2
Fast/Slow CNTL	3	EC4	C2 Pin 10
Back Light	10	4-HL1 &2	C1 Pin 7, C7 Pin 8
Back Lt JMPR	8	4-HL2	C7 Pin 10
F/S Sw GND	9	4-GN4 & 8	Splice 1, C7 Pin 7
F/S GND JMPR	7	4-GN8	C7 Pin 9

Gear Position Switch (C8)

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

Accelerator Potentiometer (C9)

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



18411 Electric Vehicle Harness
Standard Cab Schematic
Rev B 4/16/2021

Splice SP1

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

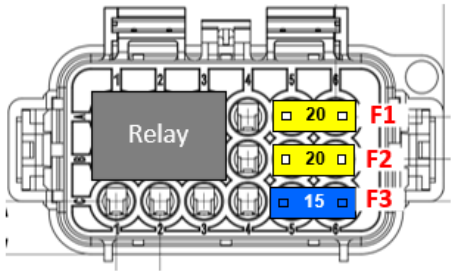
Splice SP 2

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

48 to 12V Converter C3

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

PDM 1



C3
48 to 12V
Converter

RT1
48V GND

20 Amp
B6
F2
B5

Fuse F1 20 Amp

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

EV Harness C1

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

20 Amp
A6
F1
A5

Relay R1
A1
30
87A
B3
87
B1
86
85
A3

Fuse F2 20 Amp

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

15 Amp
C6
F3
C5
SP2

Fuse F3 15 Amp

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

C1
EV Harness

SP1

RT2
48V POS

C2
48V Contactor

Relay R1

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

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

18412 Harness, Electric Vehice, PDM

Rev A 2/12/2021

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.
4. Ensure all connectors are fully mated with an audible click.

WARNING: BEFORE SERVICING ANY PART ON THE ELECTRIC VEHICLE, THE 48 VOLT BATTERY MUST BE SHUT OFF. PUSH AND HOLD THE SILVER BUTTON SWITCH ON THE SIDE OF THE BATTERY BY THE BATTERY CABLES FOR AT LEAST 5 SECONDS OR UNTIL THE BATTERY METER GOES OFF. PERMANENT ELECTRICAL COMPONENT DAMAGE COULD OCCUR IF THE BATTERY IS LEFT ON.

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 Navitas 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.

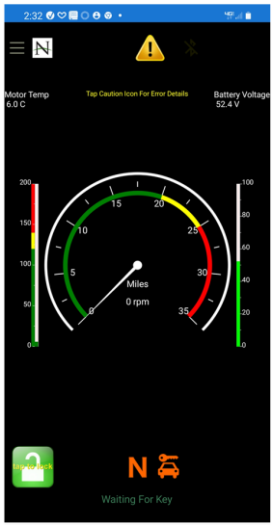
Problem	First Action	Second Action	Third Action
Vehicle will not take a charge	Verify AC Power is being supplied to the charger. Verify that 120 Volt AC power is present at the end of your extension cord. Connect to the AC power port on the side of the vehicle. Go to next step if the problem persists.		
	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 System Diagnostics

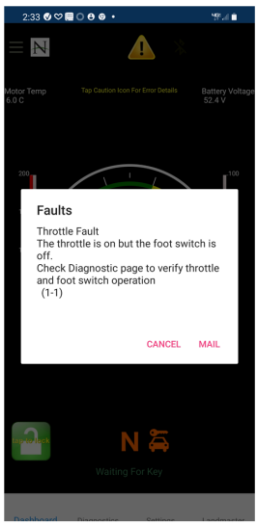
Troubleshooting the motor and controller system is aided by two methods of fault reporting. The system provides a single red warning light that is visible through the front face of the motor controller which is located in a module tray behind the driver. This light is used to display fault codes through 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.

FLASH CODE	FLASH CODE MESSAGE	DESCRIPTION	SOLUTION	HOW TO CHECK
1-1	Throttle Fault	Accelerator pedal switch operation is faulty. Switch may not be actuating. Pedal may be disconnected or a wire connection has failed.	Check that pedal connector is mated. Check that pedal switch is activated ON with the pedal is depressed at approx. 0.7 volts on the analog value. Verify that the analog pedal voltage in the Phone APP Diagnostic screen transitions to ON from approx. 0.5 volts to 3.3 volts as the pedal is depressed. If all checks prove proper power and ground feeds and the pedal switch will not activate, replace pedal.	Remove the pedal cover and verify that the connector is mated to the pedal. Verify the pedal switch activates at approx. 0.7 volts. Verify that 12 volts is present on pin F of the connector. Verify the analog pedal operation. Verify that the 5 volt supply is present. Verify that a good ground is supplied to the pedal.
1-2	Brake Fault	This interface is not used on American Landmaster	Not Applicable	Not Applicable
1-3	Charger Interlock	This interface is not used on American Landmaster	Not Applicable	Not Applicable
1-4	Temperature (Controller)	Vehicle performance is limited because the controller is over heated.	Let the vehicle cool down.	Vehicle performance is limited because the controller is over heated.
1-5	Temperature (Motor)	Vehicle performance is limited because the motor is over heated.	Let the vehicle cool down.	Vehicle performance is limited because the motor is over heated.
1-6	Solenoid High Resistance	Voltage across the solenoid is greater than 5 volts.	Verify power connections are clean and tight. If problem persist, replace solenoid.	With solenoid energized, with key ON, measure voltage across the two large terminals. Voltage should be less than 2 volts DC.

1-7	Flash Memory Error	Software code updates from the Phone App may force this error. The user should press the INITIALIZE button and then the SAVE button. The end customer should never see this code.	If the end customer sees this code, call American Landmaster Customer Service.	Call American Landmaster Customer Service.
2-1	Direction Switch Fault	Both Forward and Reverse signals are on at the same time	Check wiring from the rotary gear position switch. If wiring is correct, but problem persist, replace the rotary switch.	Verify that individual wiring feeds are supplied from the rotary switch to the controller. Remove the rotary switch harness connector and apply 12 volts individually to pins 1 and 3 and verify that the controller inputs reflect a single voltage applied to Forward and Reverse in the phone APP.
2-2	Main Solenoid	Voltage across the solenoid is greater than 1 volt.	Verify power connections are clean and tight. If problem persist, replace solenoid.	Put vehicle in Neutral. Measure voltage across the main power terminals. Turn the ignition key ON. Place vehicle in Neutral. Depress the accelerator. If solenoid clicks and the voltage across the terminals does not drop to zero, replace the contactor. If the contactor does not click, measure the voltage across the coil terminals while hooked up to the harness. It should read battery voltage. If it reads 12 volts, the solenoid is bad. If it does not read battery voltage, check the fuse in the small fuse box in the module tray.

2-3	Controller not Pre-Charging	Abnormally low voltage on the controller between B+ and B-.	Clean and dry off the controller. Verify that the battery voltage is greater than 40 volts. Charge batteries if low.	Verify that there is no debris across the battery terminals such as mud, road salts or corrosion. Verify that battery voltage across the controller equals the battery voltage across the 48 volt battery pack.
2-4	Main solenoid Current Fault	Solenoid coil takes too much current.	Check for good connections to the solenoid coil. If problem persist, replace the solenoid.	Check resistance across the solenoid coil. The resistance should be approx. 50 ohms.
2-5	Parking Brake Solenoid	This interface is not used on American Landmaster	Not Applicable	Not Applicable
3-1	Batteries Under Voltage	Batteries are totally discharged or too low	Recharge Batteries Ensure battery cables terminals are clean and tight. Check solenoid contactor operation.	Measure battery voltage while driving using the Phone App. Select the DASHBOARD screen. Verify voltage does not drop while in motion.
3-2	Batteries Over Voltage	Batteries are over charged. This condition should not occur since regenerative braking is turned off on this vehicle.	Ensure battery cables terminals are clean and tight. Check solenoid contactor operation.	Measure battery voltage while driving using the Phone App. Select the DASHBOARD screen. Verify voltage does not rise while in motion.
3-3	Motor Over current	Motor current is above the maximum motor current parameter.	Verify motor cables, U, V W are not shorted to ground.	The DIAGNOSTIC page of the APP will give you readings for the phase voltages. The phase voltages should read approx. half of the battery voltage.

4-5	Over Current Fault	Motor current has exceeded controller current limit	Release throttle and reapply to drive	Error code will clear when key is off.
4-7	Power Stage Fault	Controller has failed to power check on startup.	Check motor connections. Motor connections must be dry.	If vehicle is wet, use a towel and dry off motor connection terminals and the area between them.
4-8	Encoder A Input Fault	Speed input A is not changing when motor current is applied	Check 4 pin speed sensor connector and wiring. Check that all 4 wires are not damaged and that the terminals are fully seated.	Use a voltmeter to measure the voltage on pins 1, 2 and 3. The readings should be 5 v, 3 v and 3 v. The 4th pin should have a good connection to the 12 volt ground. (Not the 48 volt ground) Place vehicle in forward and creep forward. If Navitas APP says the input is not changing, chances are the sensor has failed. Landmaster part number 19752.
4-9	Encoder B Input Fault	Speed input B is not changing when motor current is applied	Check 4 pin speed sensor connector and wiring. Check that all 4 wires are not damaged and that the terminals are fully seated.	Use a voltmeter to measure the voltage on pins 1, 2 and 3. The readings should be 5 v, 3 v and 3 v. The 4th pin should have a good connection to the 12 volt ground. (Not the 48 volt ground) If Navitas APP says the input is not changing, chances are the sensor has failed. Landmaster part number 19752.
				Damage to the encoder sensor usually occurs when someone services the electrical components with the battery ON. Shut off the battery first.

The following issues may not show a flash code. These faults are mainly related to the vehicle and how it is being driven or utilized.

ISSUE	CAUSE	HOW TO CHECK
The vehicle is moving slower than normal.	• Batteries are discharged • Bad or damaged motor • Faulty speed sensor • Motor temp sensor is open • Motor is over heated	• Charge batteries • Swap motor if no faults present • Replace speed sensor • Ensure 2 pin sensor and wiring are intact • Let motor cool down
Vehicle is shutting down	• Check vehicle wiring for loose connections or pins pushed out of connectors. • Battery current has been exceeded for an extended period of time.	• Ensure jump start stud connections and clean and tight. • Original battery will shut down with speeds in excess of 24 MPH or with sustained temperatures above 85 degrees F.
Vehicle Stutters	• Motor cables are not connected properly.	• Ensure motor cables are properly attached. U to U, V to V and W to W.
Vehicle will not move	• AC charger is plugged in.	• Unplug the AC charger and turn the key on.
Vehicle will not charge. Very low mileage capacity.	• Reset the Battery manager in the 48 volt battery.	• Unplug the AC charger • Turn off the 48 volt battery. • Plug in the AC charger. • Verify the charger is working as shown with the battery meter showing a walking pattern. • Let the charger charge overnight and then disconnect. • Shut off the battery when the vehicle is not in use.
Vehicle will not fully charge	• Vehicle has been charged in a cold environment. (less than 40 degrees F)	• Lithium batteries must not be charged when less than 32 degrees. • AC charger will not charge the battery at temps less than about 40 degrees. • Move vehicle to a warm location for several hours before attempting to charge. Let the charge cycle complete without interruption