RXV & 2Five HANDHELD DIAGNOSTICS & TROUBLESHOOTING GUIDE

RXV & 2FIVE TROUBLESHOOTING AND DIAGNOSTICS

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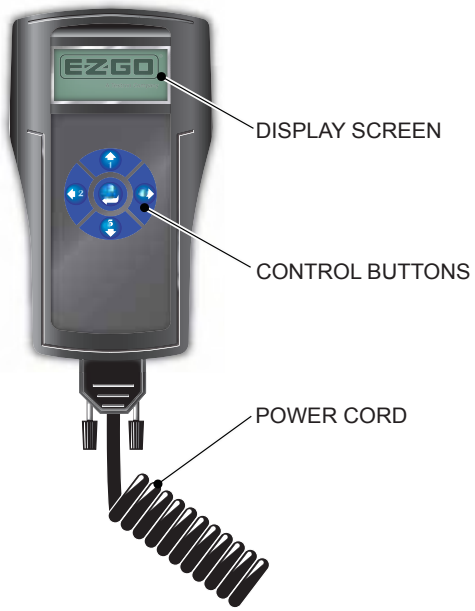
HAND HELD DIAGNOSTICS

HOW TO USE THE HAND HELD DIAGNOSTIC UNIT

The E-Z-GO Hand Held Diagnostic Unit, P/N 614400 is used for troubleshooting, tuning, programming and the retrieval of warranty information on the 48V RXV vehicle and the 2Five (LSV) vehicle.



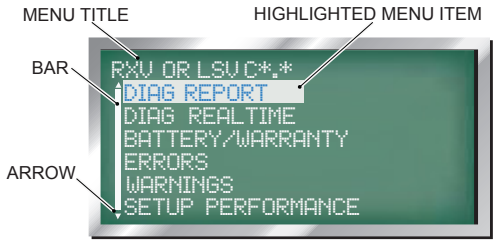
With the vehicle key switch in the 'OFF' position, the hand held diagnostic unit is connected to the vehicle by plugging the power cord connector into the receptacle (CAN) located under the vehicle cup holder. Turn the key switch on to power up the hand held. If the hand held shows 'no connection' or a blank screen, check the cord and the CAN connections and wiring.

For the 2Five vehicle, when the hand held is powered up, you must toggle the 'rabbit/turtle' switch 5 times within 8 seconds to over ride the speedometer. If this is not done, incorrect readings will occur.

When the hand held unit is powered up, it will recognize which vehicle type it is connected to and give only those specific readings for that vehicle. The hand held unit has the ability to detect an older software version and provides the user the ability to download the compatible new software.

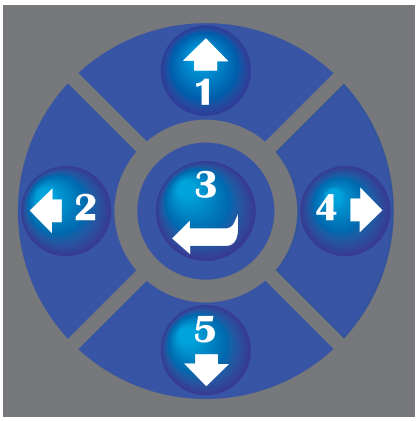
The E-Z-GO logo will display when the unit is first powered up, then the menu title is displayed on the first line of the display screen with the menu selections indented under it.

The vertical bar along the left side of the display screen moves up and down when buttons 1 or 5 are pressed. The length of the bar also changes depending on how many items are in a menu. When the bar is positioned at the top arrow the beginning of the menu has been reached; if the bar has reached the arrow at the bottom of the screen there are no more menu choices available..



To access the different diagnostic functions, use the five control buttons to scroll through the menus.

Buttons 1 and 5 will move the cursor up and down through the menu, button 4 will show the sub menu for the highlighted item. Button 2 will return to the top level menu. Button 3 is used as 'enter' or 'return'; hold the button for 3 seconds..



DIAGNOSTICS AND TROUBLESHOOTING GUIDE

MENUS

The Hand Held Diagnostic Unit, when connected to the vehicle, will provide access to information on the following:

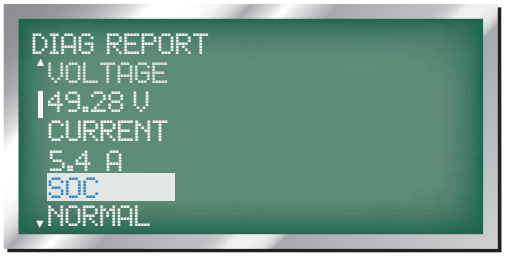
DIAGNOSTIC REPORT

BATTERY FUNCTIONS (1 - 3)

1. BATTERY VOLTAGE: displayed as 'VOLTAGE', the next line displays 'HIGH','LOW' or the actual voltage in tenths of a volt.

2. CALCULATED BATTERY CURRENT: displayed as 'CURRENT', the next line displays calculated current as 'HIGH', 'LOW' or the actual number in DC Amps.

3. STATE OF CHARGE: displayed as 'SOC', the next line displays the state of charge for the battery pack as 'HIGH', 'NORMAL' or 'LOW BATT'.



PEDAL FUNCTIONS (4 - 7)

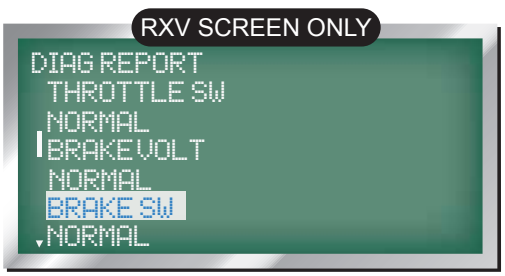
4. THROTTLE SENSOR VOLTAGE: displayed as 'THROTVOLT', the next line displays the sensor voltage as 'LOW', 'NORMAL' or 'HIGH'.

5. THROTTLE SWITCH POSITION: displayed as 'THROTTLESW', the next line displays the switch voltage as 'NORMAL' or 'ABNORMAL'.

6. BRAKE SENSOR VOLTAGE: displayed as 'BRAKEVOLT', the next line displays the sensor voltage as 'LOW', 'NORMAL' or 'HIGH'.

7. BRAKE SWITCH POSITION: displayed as 'BRAKE SW' the next line displays the switch voltage as 'NORMAL' or 'ABNORMAL'.

RXV SCREEN ONLY



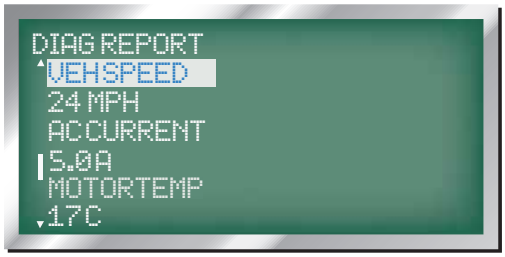
MOTOR & HEAT SINK FUNCTIONS (8 - 15)

8. MOTOR COMMAND SPEED: displayed as 'CMD-SPEED', the next line displays the speed in RPMs (revolutions per minute) that is being requested of the motor by the pedal position.

9. MOTOR ACTUAL SPEED: displayed as 'ACTSPEED', the next line displays the actual motor speed in RPMs.

10. MOTOR SPEED SENSOR displayed as 'SPEED SENSOR', displays the status of the speed sensor. For troubleshooting see errors and warning chart.

11. MOTOR VEHICLE SPEED displayed as 'VEH-SPEED', gives warning for a speed sensor error.

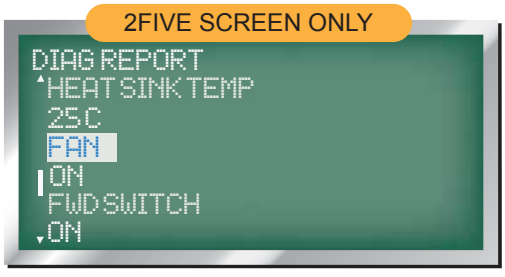


12. MOTOR CURRENT: displayed as 'AC CURRENT', the next line displays the AC current in Amps.

13. MOTOR TEMPERATURE: displayed as 'MOTOR-TEMP', the next line displays the internal motor temperature in °C.

14. CONTROLLER HEAT SINK TEMPERATURE: displayed as 'HEAT SINK TEMP', the next line displays the temperature in °C.

15. FAN function is displayed as "FAN", the next line displays whether or not the controller cooling fan is on or off.



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INPUT FUNCTIONS (16 - 18)

16. FORWARD SWITCH: displayed as 'FWD SWITCH', the next line displays the switch position as 'ON' or 'OFF'.

17. REVERSE SWITCH: displayed as 'REV SWITCH', the next line displays the switch position as 'ON' or 'OFF'.

18. RUN TOW SWITCH POSITION: displayed as 'RUN TOW SW', the next line displays the position of the run/tow switch as 'RUN' or 'TOW'.

OUTPUT FUNCTIONS (19 - 20)

19. REVERSE WARNING BUZZER: displayed as 'BUZZER', the next line displays the buzzer state as 'ON' or 'OFF'.

20. SOLENOID: displayed as 'SOLENOID', the next line displays the solenoid state as 'ON' or 'OFF.

BRAKE FUNCTIONS (21)

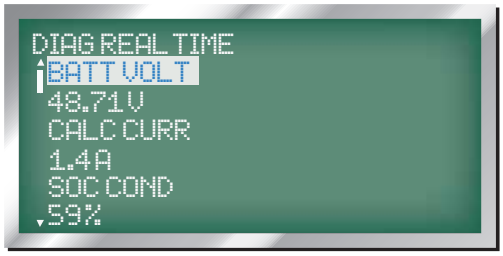
21. ELECTRIC BRAKE CURRENT: displayed as 'EBRAKECURR', the next line displays the brake current as a three place decimal in Amps; the brake current displayed below is 3 milliAmps.

Press button #2 to get back to main screen

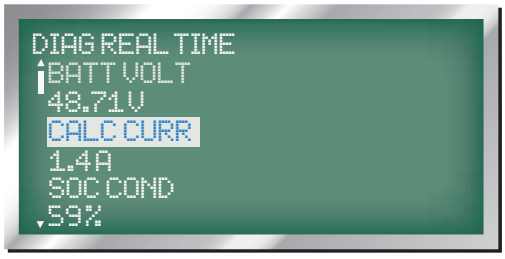
DIAGNOSTICS REPORT (real - time read only)

BATTERY FUNCTIONS - REAL TIME (22 - 25)

22. BATTERY VOLTAGE: displayed as 'VOLTAGE', the next line displays the actual voltage in tenths of a volt.

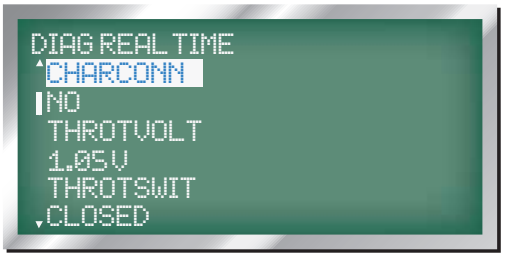


23. CALCULATED BATTERY CURRENT: displayed as 'CURRENT', the next line displays the actual number in DC Amps.



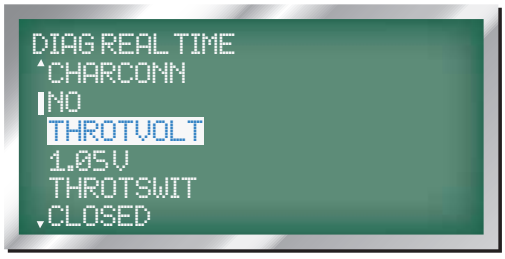
24. STATE OF CHARGE: displayed as 'SOC', the next line displays the state of charge for the battery pack IN percentage (%). .

25. CHARGER CONNECTED: displayed as 'CHARCONN', the next line displays that the charger is connected by 'Yes' or 'NO'.

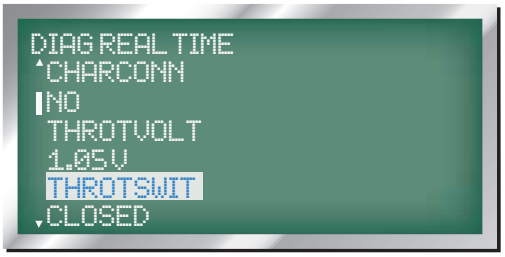


PEDAL FUNCTIONS (26 - 28)

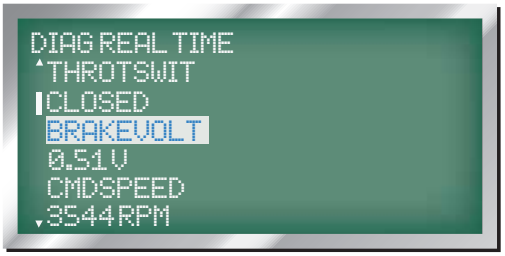
26. THROTTLE SENSOR VOLTAGE: displayed as 'THROTVOLT', the next line displays the sensor voltage.



27. THROTTLE SWITCH POSITION: displayed as 'THROTTLESW', the next line displays the switch voltage as 'OPEN' or 'CLOSED'.

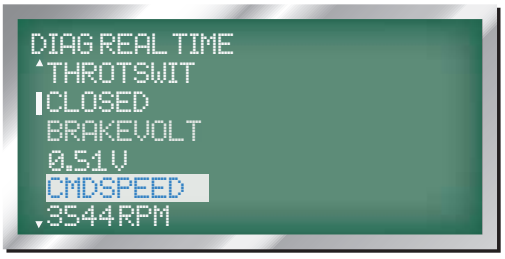


28. BRAKE SENSOR VOLTAGE: displayed as 'BRAKEVOLT', the next line displays the sensor voltage.



MOTOR AND HEAT SINK FUNCTIONS (29 - 36)

29. MOTOR COMMAND SPEED: displayed as 'CMDSPEED', the next line displays the speed in RPMs (revolutions per minute) that is being requested of the motor by the pedal position.



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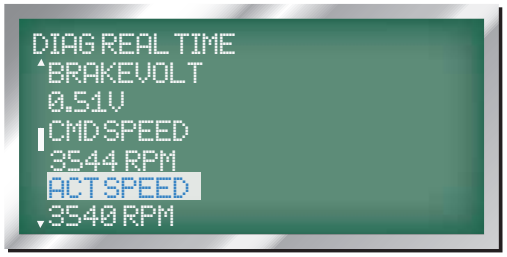
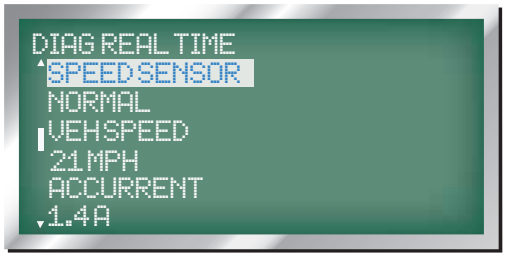
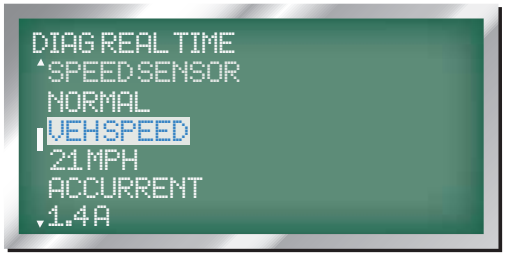
30. MOTOR ACTUAL SPEED: displayed as 'ACTSPEED', the next line displays the actual motor speed in RPMs.



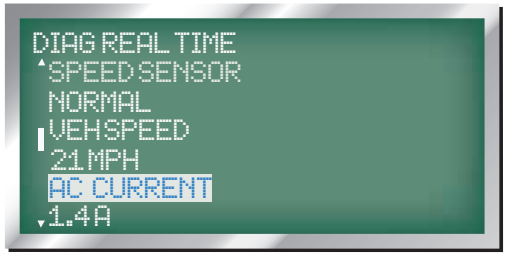
31. MOTOR SPEED SENSOR displayed as 'SPEED SENSOR', displays the status of the speed sensor. For troubleshooting see errors and warning chart.



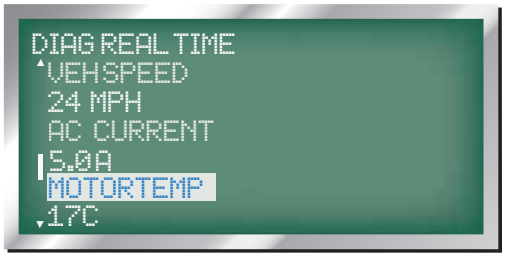
32. MOTOR VEHICLE SPEED displayed as 'VEH-SPEED', shows the actual speed of the vehicle in miles per hour.



33. MOTOR CURRENT: displayed as 'AC CURRENT', the next line displays the AC current in Amps.

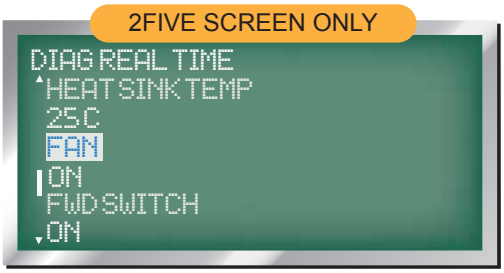


34. MOTOR TEMPERATURE: displayed as 'MOTOR-TEMP', the next line displays the internal motor temperature in °C.



35. .CONTROLLER HEAT SINK TEMPERATURE: displayed as 'HEATSINKTEMP', the next line displays the heat sink temperature in °C.

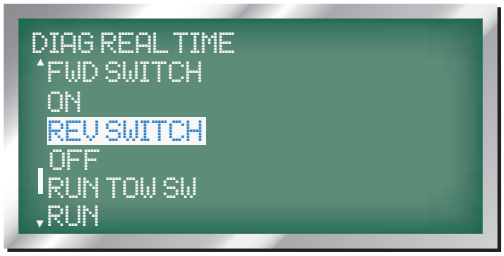
36. FAN function is displayed as "FAN", the next line displays whether or not the controller cooling fan is on or off. .



INPUT FUNCTIONS (37 - 39)

37. FORWARD SWITCH: displayed as 'FWD SWITCH', the next line displays the switch position as 'ON' or 'OFF'.

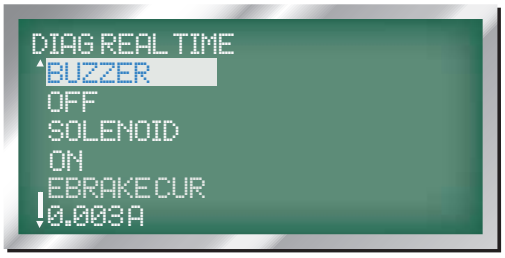
38. REVERSE SWITCH: displayed as 'REV SWITCH', the next line displays the direction selection as 'ON' or 'OFF'.



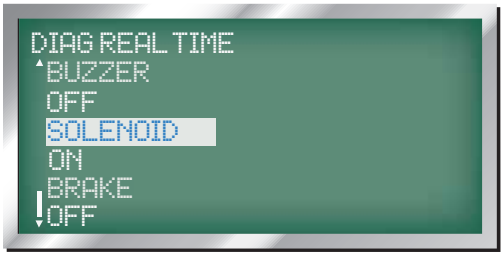
39. RUN TOW SWITCH POSITION: displayed as 'RUN TOW SW', the next line displays the position of the run/tow switch as 'RUN' or 'TOW'.

OUTPUT FUNCTIONS (40 - 42)

40. REVERSE WARNING BUZZER: displayed as 'BUZZER', the next line displays the buzzer state as 'ON' or 'OFF'.

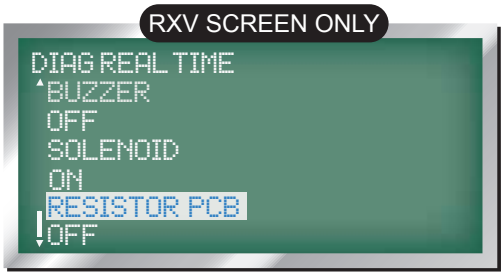


41. SOLENOID: displayed as 'SOLENOID', the next line displays the solenoid state as 'ON' or 'OFF'.



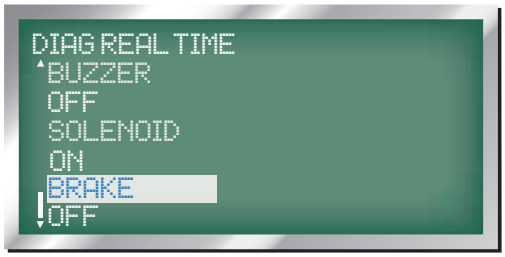
42. RESISTOR CONTROLLER: displayed as 'RESISTOR PCB', the next line displays "ON" or "OFF".

RXV SCREEN ONLY



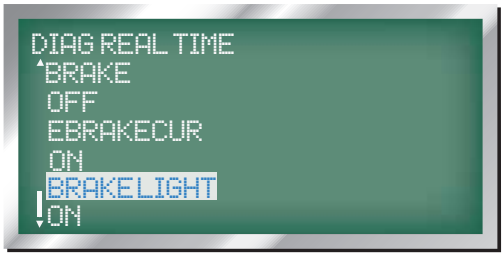
BRAKE FUNCTIONS (43 - 45)

43. ELECTRIC BRAKE: displayed as 'BRAKE', the next line displays the electric brake state as 'ON' or 'OFF'.



44. ELECTRIC BRAKE CURRENT: displayed as 'EBRAKECURR', the next line displays the brake current as a three place decimal in Amps; the brake current displayed below is 3 milliAmps.

45. BRAKE LIGHT: displayed as 'BRAKELIGHT', the next line displays the brake light state as 'ON' or 'OFF'.



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BATTERY AND WARRANTY (read only)

Display parameters based on data stored in the vehicle controller.

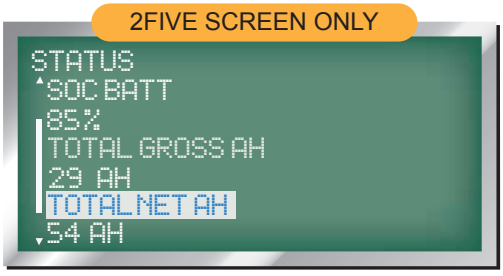
STATUS (46 - 51)

46. STATE OF BATTERY CHARGE: displayed as 'SOC-BATT', the next line displays the battery pack state of charge in percentage (%).

47. TOTAL GROSS AMP-HOURS: displayed as 'TOTAL GROSS AH', this is the total Amp-Hours used for the life of the vehicle.

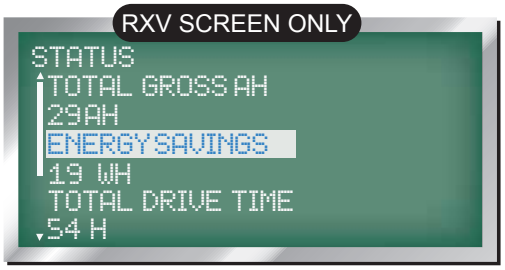
48. TOTAL NET AMP-HOURS: displayed as 'TOTAL NET AH', this is the total net Amp-Hours used for the life of the vehicle.

2FIVE SCREEN ONLY

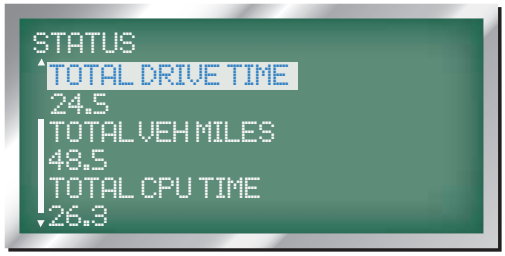


OR
TOTAL ENERGY SAVINGS: dislpayed as 'ENERGY SAVINGS', this is the watt-hours saved for the life of the car.

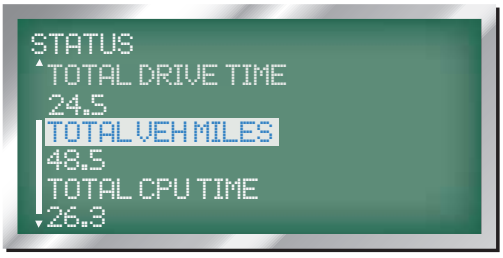
RXV SCREEN ONLY



49. TOTAL RUNNING TIME: displayed as 'TOTAL DRIVE TIME', the next line displays the number of hours of running time (pedal down) on the vehicle in hours.



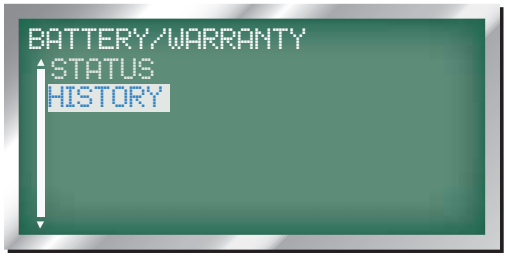
50. TOTAL MILEAGE OF THE VEHICLE: displayed as 'TOT VEH MILES', the next line displays the total mileage of the vehicle in miles in 10ths.



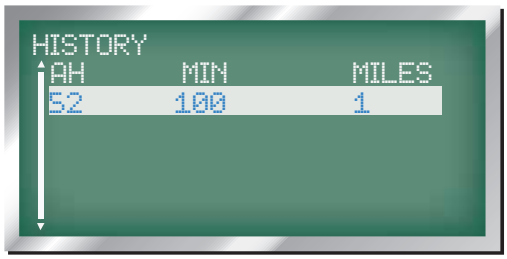
51. TOTAL LIFETIME OF THE CONTROLLER: displayed as 'TOTAL CPU TIME', the next line displays the total lifetime of the controller in hours and 10ths.

HISTORY (52 - 54)

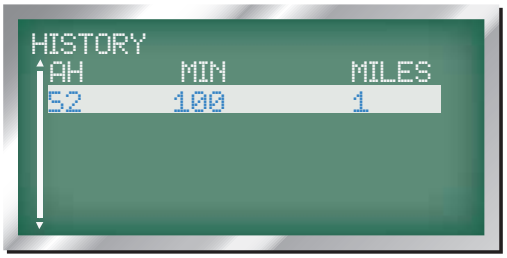
The HISTORY screen displays the total number of amp hours, the minutes and the miles of the vehicle for recent charge cycles. If the controller senses a charge cysle with the key off and a 20% rise in battery voltage, then this screen will reset to all "0" for that days usage. This screen is for toubleshooting.



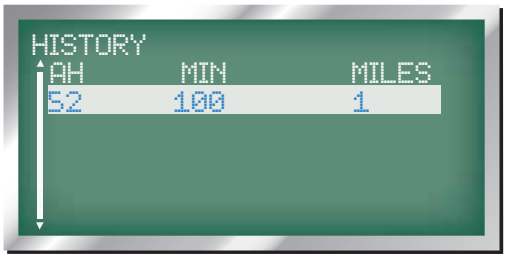
52. TOTAL GROSS AMP HOURS USED FOR THE LIFE OF THE CAR: displayed as 'GROSS AH', the next line displays gross amp hours used as a whole number since the last recorded charge cycle.



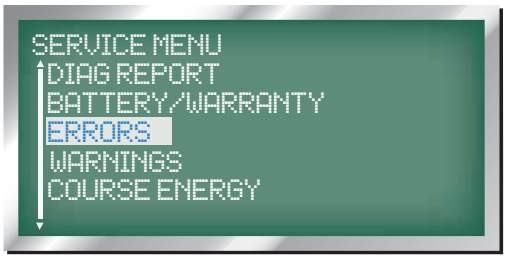
53. TOTAL RUN TIME ON VEHICLE IN MINUTES: displayed as 'MIN', this is the total run time on vehicle in minutes since the the last recorded charge cycle.



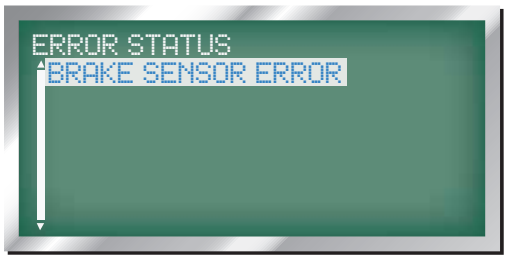
54. TOTAL MILEAGE OF THE VEHICLE: displayed as 'MILES', this is the total mileage of the vehicle in whole numbers in 10ths of a mile since the last recorded charge cycle.



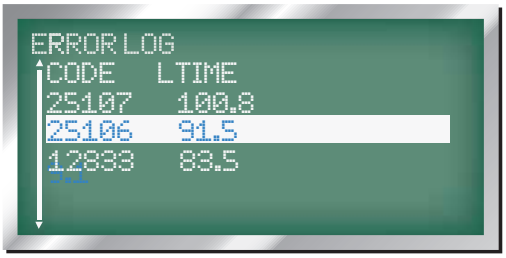
ERROR MESSAGES (55 - 56)



55. Current Error Message is displayed on the ERROR STATUS screen and spells out the error.



56. Past 7 Error Codes are displayed on ERROR LOG. The error code along with the CPU time (see screen 51) when the error occurred.



DIAGNOSTICS AND TROUBLESHOOTING GUIDE

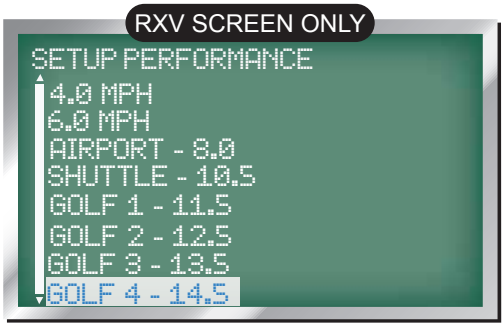
WARNING MESSAGES (57)

57. The active description of warning at that time.

SETTING TOP SPEED AND PERFORMANCE PROFILES (read and write) *RXV ONLY* (58 - 59)

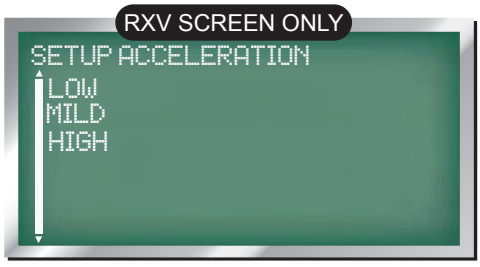
58. To change the **speed**, scroll down the list and highlight one of the vehicles; 4.0 mph, 6.0 mph Airport, Shuttle or Golf 1, 2, 3 & 4 profiles. After selecting the desired speed press the enter key (button 3) then turn the key switch to 'OFF', once the key switch is turned back on the vehicle will display the new speed setting on the hand held unit.

RXV SCREEN ONLY



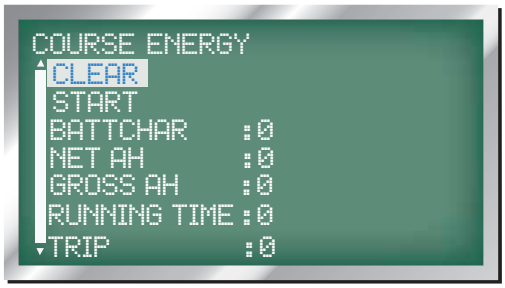
59. To change the **acceleration**, scroll down the list, highlight one of the settings.After selecting desired speed press enter key (button 3) then turn key switch to 'OFF', once key switch is turned back on, vehicle will display new speed setting on hand held unit which is ramp up rate from stop to full speed, time in seconds.

RXV SCREEN ONLY

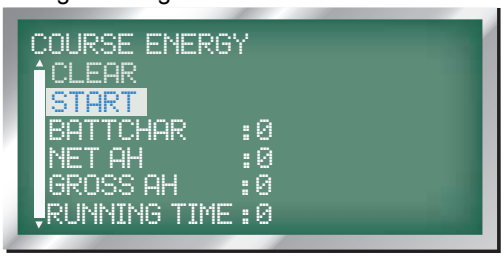


COURSE ENERGY CONSUMPTION (read only) (60 - 68)

60. Scroll down to 'CLEAR' and press the enter key (button 3) to clear the energy consumption.

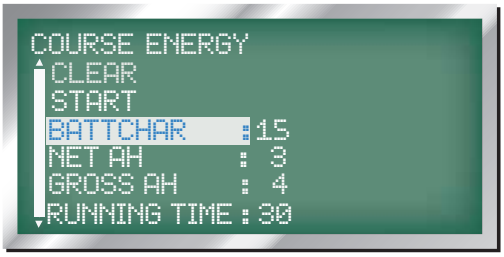


61. Scroll down to 'START' and press the enter key (button 3) to begin recording the energy consumption and begin driving.



62. To 'STOP' the recording make sure that 'STOP' is highlighted and press the enter key (button 3). The energy consumed will be displayed on the screen.Cycling the key or disconnecting the hand held will reset the screen.

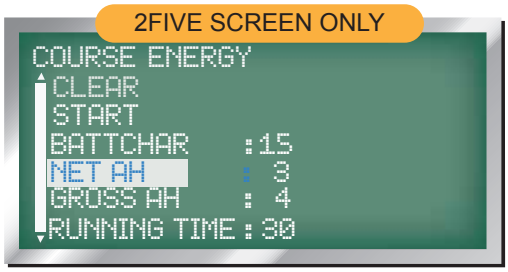
63. NET STATE OF BATTERY CHARGE CONSUMED: displayed as '%' as a whole number.



DIAGNOSTICS AND TROUBLESHOOTING GUIDE

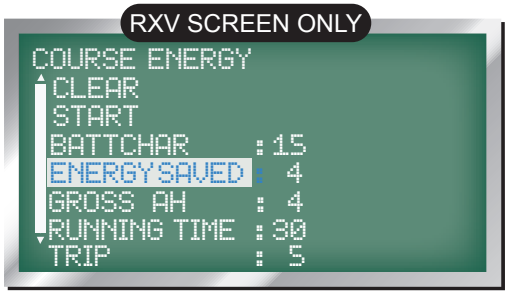
64. NET AMP-HOURS USED FOR THE ROUND:displayed as a whole number. .

2FIVE SCREEN ONLY



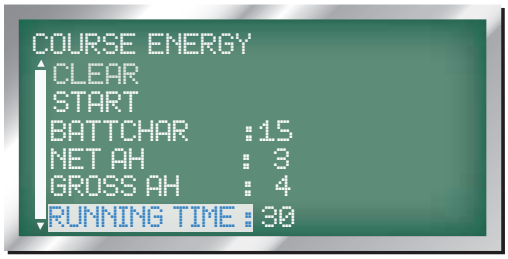
65. ENERGY SAVED is displayed in watt hours as a whole number..

RXV SCREEN ONLY

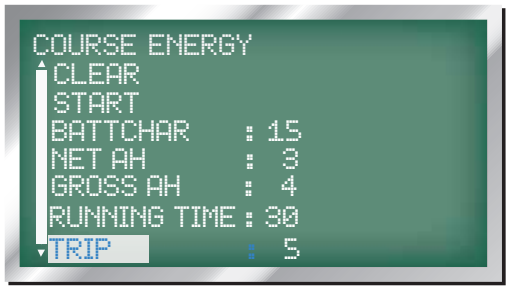


66. GROSS AMP-HOURS USED FOR THE ROUND displayed as a whole number.

67. NET RUNNING TIME ON THE VEHICLE: displayed in # of minutes. .



68. DISTANCE TRAVELED DURING RECORDING:displayed as 'TRIP', shows the distance traveled during recording in miles 'MI', whole number to the 10ths.



DIAGNOSTICS AND TROUBLESHOOTING GUIDE

TROUBLESHOOTING

In order to effectively troubleshoot the circuits that include the horn, lighting, brake/turn signals and gauges, the technician must be able to use the wiring diagram and a DVOM.

The wiring diagram shows the path followed by voltage or a signal from its origination point to its destination. Each wire is indicated by color.

The technician should use simple logic troubleshooting in order to reduce the number of steps required to isolate the problem.

Example 1: If the vehicle will not start or none of the lights function (or burn dimly) the battery should be tested before trying to troubleshoot the lighting circuit.

Example 2: If a problem occurs in the lighting circuit that results in only one of the headlights not working, there is no reason to check battery wiring or the fuse since it is obvious that voltage is present. Since bulbs will burn out over time, the obvious place to start is at the headlight that is not functioning. if power is present at the connector and the ground wiring is satisfactory, the only possibilities that exist are a burned out bulb or a poor contact between the connectors and the headlight.

If power is not present but the other headlight functions, a wiring problem is indicated between the two headlights.

In some cases where battery voltage is expected, the easiest way to test the circuit is to set the DVOM to DC volts and place the negative (-) probe of the DVOM to the negative battery terminal. Move the positive (+) probe to each wire termination starting at the battery and working out to the device that is not working. Be sure to check both sides of all switches and fuses.

When no battery voltage is found, the problem lies between the point where no voltage is detected and the last place that voltage, was detected. In circuits where no voltage is expected, the same procedure may be used except that the DVOM is set to continuity. Place the negative (-) probe on a wire terminal at the beginning of the circuit and work towards the device that is not working with the positive (+) probe. When continuity is no longer indicated, a failed conductor or device is indicated.

ACCESSORY WIRING HARNESS

After determining that there is power to the fuse and the fuse is good, continue checking the circuit using the procedures previously used to check the power supply, i.e. loose or rusted connections, bare wires, continuity of the wiring from terminal to terminal, operating condition of switch, etc.

Use the wiring diagram to check correct wiring and wire routing. If there is power at the fuse end of the wire, there must also be power at the other end of the wire at the switch or electrical accessory, and eventually at the ground connection. Electricity must flow from the fuse through the full length of the circuit to the ground connection. Any interruption of electricity flow must be corrected, whether by repairing or replacing the wire, the switch or the accessory.

DIAGNOSTICS AND TROUBLESHOOTING GUIDE

POWER SUPPLY

Tool List	Qty.
DVOM	1

Check For Loose or Bare Wires

Check for loose wires at each terminal connection and for worn insulation or bare wires touching the frame. Bare wires may cause a short circuit.

NOTICE

If any DVOM readings indicate a faulty wire, it is recommended that the condition of the terminals and wire junction be examined. A faulty wire should be replaced with one of the same gauge and color and wired between the correct components and wire tied to the harness bundle. The faulty wire should be cut back close to the harness and the ends protected with vinyl electrical tape.

Check Battery Condition

Check for adequate battery volts (nominal 48 VDC for entire set or 12V per battery) by setting DVOM to 50 VDC range and place the red probe (+) on the battery post with the green wire attached. Place the black probe (-) on the battery post with the black wire attached. A reading of 11 VDC or greater indicates adequate battery condition. No reading indicates (a) a poor connection between the probes and the battery terminals; (b) a faulty DVOM. A voltage reading below 11 volts indicates poor battery condition and the vehicle should be recharged before proceeding with the test.

THE FOLLOWING PAGES WILL GIVE YOU *ERROR AND WARNING CODES* THAT ARE SPECIFIC TO EACH VEHICLE.

THE FIRST SECTION IS FOR THE *RXV VEHICLE*

THE SECOND SECTION IS FOR THE *2FIVE VEHICLE*.

PLEASE ENSURE YOU USE THE CORRESPONDING SECTIONS AS NEEDED FOR THE VEHICLE YOUR ARE CURRENTLY WORKING ON.

DIAGNOSTICS AND TROUBLESHOOTING GUIDE

RXV

RXV ERRORS AND CODES

CODE	DESCRIPTION	POSSIBLE CAUSES	DIAGNOSTIC STEP	ACTION (post diagnostics)
8976	AC Over Current	1. Software detects motor current 50% higher than controller peak rated current. NOTE: this error is seldom seen. It is usually the result of motor parameters such as stator inductance or resistance being out of spec. Transient Events can also cause this error without a component failure	1. Turn key to 'OFF' and then back 'ON'. If car does not run proceed to step 2. 2. Disconnect U, V, W from controller. Check resistance between U -V, V-W, and U-W, each should be 0.4-0.8 Ohms. If readings are out of range see ***ACTION 1***. If readings are in range and car does not run proceed to step 3. 3. Remove controller from the non-running car and install it in a running car, if this vehicle does not run with this controller the controller is suspect. See ***ACTION 2***	1. Replace Motor 2. Replace Controller
9024	AC Short Circuit	1. Short circuit detected in controller, motor cable or motor.	1. Turn key to 'OFF' and then back 'ON'. If car does not run proceed to step 2. 2. Disconnect U, V, W from controller. Check resistance between U -V, V-W, and U-W, each should be 0.4-0.8 Ohms. If readings are out of range see ***ACTION 1***. If readings are in range and car does not run proceed to step 3. 3. Remove controller from the non-running car and install it in a running car, if this vehicle does not run with this controller the controller is suspect. See ***ACTION 2***	1. Replace Motor 2. Replace Controller
12576	DC Bus Timeout	1. DC Bus voltage has not reached 24 volts within 10 seconds after key switch start.	1. Check battery voltage across all 4 batteries, voltage should read 42 VDC minimum, if O.K. proceed to step 2. 2. Check voltage across solenoid contacts, if more than 3 VDC but less than 24 VDC proceed to step 3, if not see ***ACTION 3***. 3. Remove resistor control module connection to controller B- terminal, if error status changes follow ***ACTION 1***.	1. Replace resistor control module. 2. If error does reoccur then replace controller. 3. Replace solenoid.
12817	DC Bus High - Software Detected	1. Battery Pack voltage is over 63 volts. NOTE: It is unlikely this error will occur in the factory. If it occurs in the field during regenerative braking, energy is transferred from the controller back to the battery pack raising the DC Bus voltage and battery pack terminal voltage only if the energy burn circuit is not properly functioning.	1. Verify that all battery wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and battery post. 2. Check the battery voltage across all 4 batteries, voltage should read 63 VDC **MAXIMUM**. 3. Check voltage across solenoid contacts. If more than 3 VDC but less than 24 VDC proceed to step 3, if it does not fall in this range follow ***ACTION 3***. 4. Verify power resistor ohm reading is between 0.2 and 0.5 ohms. 5. Remove resistor control module connection to controller B- terminal. If error status changes follow ***ACTION 1***.	1. Tighten or replace loose or high resistance power wire connections. 2. Replace power resistor. 3. Replace solenoid. 4. Replace resistor control module. 5. If error continues, replace the controller.

DIAGNOSTICS AND TROUBLESHOOTING GUIDE

CODE	DESCRIPTION	POSSIBLE CAUSES	DIAGNOSTIC STEP	ACTION (post diagnostics)
12818	DC Bus High - Hardware Detected	1. Battery Pack voltage is over 67 volts. NOTE: It is unlikely this error will occur in the factory and very rarely in the field. If it occurs in the field the most likely cause is a loose power wire or and internal controller fault	1. Verify that all battery wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and battery post. 2. Check the battery voltage across all 4 batteries, voltage should read 63 VDC **MAXIMUM**. 3. Check voltage across solenoid contacts. If more than 3 VDC but less than 24 VDC proceed to step 3, if it does not fall in this range follow ***ACTION 3***. 4. Verify power resistor ohm reading is between 0.2 and 0.5 ohms. 5. Remove resistor control module connection to controller B- terminal. If error status changes follow ***ACTION 1***.	1. Tighten or replace loose or high resistance power wire connections. 2. Replace power resistor. 3. Replace solenoid. 4. Replace resistor control module. 5. If error continues, replace the controller.
12833	DC Bus Low - Software Detected	1. Controller DC Bus voltage has dropped below 18 volts.	1. Verify that all battery wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and battery post. 2. Check the battery voltage across all 4 batteries, voltage should read 42 VDC **Minimum**. 3. Check voltage across solenoid contacts. If more than 3 VDC but less than 24 VDC proceed to step 3, if it does not fall in this range follow ***ACTION 3***. 4. Verify power resistor ohm reading is between 0.2 and 0.5 ohms. 5. Remove resistor control module connection to controller B- terminal. If error status changes follow ***ACTION 1***.	1. Tighten or replace loose or high resistance power wire connections. 2. Replace power resistor. 3. Replace solenoid. 4. Replace resistor control module. 5. If error continues, replace the controller.
16912	Motor Temp High	1. Vehicle is heavily loaded or overloaded. 2. Motor temperature of greater than or equal to 150°C (302°F), NOTE: 1300 ohms equals a motor temperature of 150°C.	1. Check external motor temperature, it should be less than 120°C (248°F). 2. Check thermocouple resistance, it should be more than 400 ohms and less than 1300 ohms. If not between these numbers perform ***ACTION 3***.	1. Allow motor to cool. 2. Reduce payload or travel grade. 3. Replace motor. 4. Replace the controller.
17168	Heat Sink Temp High	1. Vehicle is heavily loaded or overloaded. 2. Controller temperature is greater than or equal to 120°C (248°F).	1. Check the external heat sink temperature, it should be less than 80°C (176°F).	1. Allow to cool. 2. Reduce payload or travel grade. 3. Replace the controller.
20753	15V Supply Low Voltage	1. Problem with the reverse warning alarm (shorted) 2. Problem with controller's internal 15 volt supply.	1. With vehicle 'OFF', unplug 23 pin connector from the controller and measure the reverse alarm resistance, value should be between 100 ohms and 500 ohms. Perform ***ACTION 1***. 2. With vehicle 'OFF', unplug 23 pin connector from the controller and measure the relay resistance, value should be between 1 ohm and 50 ohms. Perform ***ACTION 2***.	1. Replace reverse alarm. 2. Replace controller.

DIAGNOSTICS AND TROUBLESHOOTING GUIDE

RXV

CODE	DESCRIPTION	POSSIBLE CAUSES	DIAGNOSTIC STEP	ACTION (post diagnostics)
20755	5V Supply Low or High Voltage	1. Typically caused by a short in the 5 volt wire harness. 2. Malfunction in the controller's 5 volt (sensor) supply. 3. SOC meter (if equipped) may be shorted. 4. Resistor control module may be shorted.	1. Check both +5V and 5V GND to chassis, resistance should be more than 10k ohms, if less perform ***ACTION 1***. 2. Check throttle and brake sensor for a short condition, if shorted perform ***ACTION 2***. 3. Check motor encoder for a short condition, if shorted perform ***ACTION 3***. 4. Check SOC meter (if equipped) for a short condition, if shorted perform ***ACTION 4***.	1. Replace wire harness. 2. Replace sensor. 3. Replace encoder. 4. Replace SOC meter. 5. Replace controller.
21008	Current Sensor Offset Calibration Error	1.Error detected in controller current measurement hardware.	1. Verify that U, V and W motor wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and power post. 2.Check resistance between U-V, V-W and U-W, each should be 0.4 - 0.8 ohms.	1. Replace controller.
21520	Open Drain Outputs Current High	1. Current in an open drain output (reverse warning alarm, park brake, resistor control, solenoid or brake relay) is more than rated current.	1. Check each output drain device (reverse warning alarm, park brake, resistor control, solenoid or brake relay) for a shorted condition (less than 0.1 ohms) with the key in the 'OFF' position.	1. If shorted condition is found replace shorted component. 2. Replace controller.
25104	EDump Failed/Startup Check Failed	1. Resistor control circuit failed at startup. 2. Welded solenoid)	1. Ensure continuity on gray wire from controller to resistor assembly. 2. Check for shorted resistance across solenoid coil.	1. Replace wiring. 2. Replace solenoid
25105	Throttle Sensor Error	1. Throttle position sensor has a low voltage condition, less than 0.35 volts. 2. Throttle position sensor has a high voltage condition, greater than 4.8 volts. 3. Throttle position sensor has a voltage less than 0.85 volts when throttle switch closes.	1. Verify that the 5 volt out put range is 5 volts ±0.1 volts. 2. Turn key switch to 'N' and place that the accelerator pedal is in the upright position. 3. Verify that accelerator pedal arm is in contact with the rubber bumper, if not in contact with bumper see ***ACTION 1***. 4. Verify the throttle sensor voltage is between 0.35 volts and 4.8 volts. If not in range see ***ACTION 2***. 5. Verify the throttle sensor voltage is less than or equal to 0.85 volts when throttle switch closes. If greater than 0.85 volts see ***ACTION 3***. 6. Verify other 5 volt supply devices; motor encoder, resistor module and brake sensor. 7. If diagnostic steps 1 and 3-6 fail see ***ACTION 5***.	1. Remove obstruction. 2. Replace throttle sensor. 3. Replace throttle switch. 4. Repair or replace bad device. 5. Replace controller.

DIAGNOSTICS AND TROUBLESHOOTING GUIDE

CODE	DESCRIPTION	POSSIBLE CAUSES	DIAGNOSTIC STEP	ACTION (post diagnostics)
25106	Reverse Alarm Test Failed OR Direction error	1. Reverse warning alarm failed at startup check. The controller tests for a completed reverse warning alarm circuit.	IF reverse warning is NOT functional, then: 1. Turn key switch to 'OFF' and unplug 23 pin connector from controller. 2. Check the reverse warning alarm for a shorted condition, less than 0.1 ohms, by measuring between pin 10 and pin 13 with the Run/Tow switch in the 'TOW' position. If test is greater than 0.1 ohms see ***ACTION 1***. 3. Turn key switch to 'R' and verify voltage to the reverse warning alarm is 48 volts, if not then see ***ACTION 2***. If reverse warning IS functional, then: 1. Remove key switch, with switch in 'FWD' and check A-C and A-D, either A-C or A-D when tested should read less than 0.1 ohms, NOT BOTH. 2. Repeat step 1 with switch in 'REV', if step 1 or 2 fail see ACTION 4. 3. Remove 23 pin connector from controller. Check mating connector to key switch, pin C and D for a reading of less than 0.1 ohms, if over 0.1 ohms see ACTION 2. 4. If steps 1-3 check out good, then see ACTION 3.	1. Replace reverse warning alarm. 2. Replace wiring harness 3. Replace controller 4. Replace key switch
25107	Mechanical Brake Failed	1. Parking brake failed to prevent motor from rotating during the park brake startup test. NOTE: this fault may occur if the key switch is turned to 'OFF' and then to 'ON' quickly while the vehicle is moving.	1. Turn key switch to 'OFF' and try to push the vehicle, it should NOT move. 2. Unplug the harness from the motor brake. 3. Verify brake coil resistance is 27 ±3 ohms, if out of range see ***ACTION 1***. 4. Verify that friction disk is in alignment, if not aligned see ***ACTION 2***. 5. Turn key switch to 'ON' and with the 'Run/Tow' switch to 'RUN' and try to push the car.	1. Replace motor brake. 2. Realign the friction disk. 3. Replace the controller.
25108	Brake Sensor Error	Brake position sensor input is out of range, there are three conditions which can cause this error. 1. Low sensor voltage, less than 0.35 volts. 2. High sensor voltage, greater than 4.8 volts. 3. Sensor voltage greater than 0.85 volts when brake switch closes.	1. Verify that the 5 volt out put range is 5 ±0.1 volts. 2. Turn key switch to 'N' and check that the accelerator pedal is in the upright position. 3. Verify that accelerator pedal arm is in contact with the rubber bumper, if not in contact with bumper see ***ACTION 1***. 4. Verify the throttle sensor voltage is between 0.35 volts and 4.8 volts. If not in range see ***ACTION 2***. 5. Verify the throttle sensor voltage is less than or equal to 0.85 volts when throttle switch closes. If greater than 0.85 volts see ***ACTION 3***. 6. Verify that the 5 volt supply devices; motor encoder, resistor module and brake sensor.	1. Remove obstruction. 2. Replace throttle sensor. 3. Replace throttle switch. 4. Repair or replace bad device.

DIAGNOSTICS AND TROUBLESHOOTING GUIDE

R
X
V

CODE	DESCRIPTION	POSSIBLE CAUSES	DIAGNOSTIC STEP	ACTION (post diagnostics)
33024	CAN Timeout	1. This error occurs when the controller and the handled devices stop communicating.	1. Check for a loose handheld connection or a damaged handheld. Replace the CAN Bus plug (run plug).	1. Cycle the key switch (turn it off then back on). 2. Depress accelerator pedal, release and depress again.
Warning	Drive Fault	1. Indicates the current error is the result of a condition internal to the controller. The message can appear in combination with one of the above error messages.	1. Trouble shoot according to the controller error message displayed.	1. Replace motor controller
Warning	DC Bus Low	DC Bus voltage is less than 24 volts.	1. Verify that all battery wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and battery post. 2. Check the battery voltage across all 4 batteries, voltage should read 42 VDC **MINIMUM**. 3. Check voltage across solenoid contacts. If more than 3 VDC but less than 24 VDC proceed to step 3, if it does not fall in this range follow ***ACTION 3***. 4. Verify power resistor ohm reading is between 0.2 and 0.5 ohms. 5. Remove resistor control module connection to controller B- terminal. If error status changes follow ***ACTION 1***.	1. Tighten or replace loose or high resistance power wire connections. 2. Replace power resistor. 3. Replace solenoid. 4. Replace resistor control module. 5. If error continues, replace the controller.
Warning	DC Bus High	Controller DC Bus voltage is greater than 67 volts.	1. Verify that all battery wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and battery post. 2. Check the battery voltage across all 4 batteries, voltage should read 63 VDC **MAXIMUM**. 3. Check voltage across solenoid contacts. If more than 3 VDC but less than 24 VDC proceed to step 3, if it does not fall in this range follow ***ACTION 3***. 4. Verify power resistor ohm reading is between 0.2 and 0.5 ohms. 5. Remove resistor control module connection to controller B- terminal. If error status changes follow ***ACTION 1***.	1. Tighten or replace loose or high resistance power wire connections. 2. Replace power resistor. 3. Replace solenoid. 4. Replace resistor control module. 5. If error continues, replace the controller.
Warning	BDI Calibration	1. The DC Bus measurement system is not calibrated.	no diagnostic steps to perform	1. Replace the controller
Warning	Motor Temp High	1. Measured motor temperature is greater than 140°C (284°F) but less than 150°C (302°F). Linear torque current reduction is active, drivability is affected (reduced speed).	1. Check external motor temperature, should be less than 120°C (248°F). 2. Check thermocouple resistance, should be more than 400 ohms and less than 1300 ohms, if out of range perform ***ACTION 3***.	1. Allow time to cool. 2. Reduce payload or driving grade. 3. Replace motor. 4. Replace controller.
Warning	Motor Temp Sensor	1. Motor temperature sensor is shorted or not connected.	1. Check external motor temperature, should be less than 120°C (248°F). 2. Check thermocouple resistance, should be more than 400 ohms and less than 1300 ohms, if out of range perform ***ACTION 3***.	1. Allow time to cool. 2. Reduce payload or driving grade. 3. Replace motor. 4. Replace controller.

DIAGNOSTICS AND TROUBLESHOOTING GUIDE

CODE	DESCRIPTION	POSSIBLE CAUSES	DIAGNOSTIC STEP	ACTION (post diagnostics)
Warning	Heat Sink Temp Low	1. Controller heat sink temperature is less than -20°C (-4°F). Max torque current reduction is active, drivability is affected. This condition normally goes away after a few minutes of operation when the heat sink warms up to a temperature greater than -20°C (-4°F).	1. Check external heat sink temperature, it should be more than -20°C (-4°F). 2. If heat sink temperature is greater than -20°C (-4°F) then see ***ACTION 2***.	1. Warm vehicle to greater than -20°C (-4°F). 2. Replace controller.
Warning	Heat Sink Temp High	1. Measured heat sink temperature is greater than 85°C (185°F) but less than 115°C (239°F), linear torque current reduction is active, drivability is affected.	1. Check external heat sink temperature, should be less than 80°C (176°F).	1. Allow time to cool. 2. Reduce payload or driving grade. 3. Replace controller.
Warning	Heat Sink Temp Sens	1. Heat sink temperature sensor shorted or not connected.	1. Check external heat sink temperature, it should be more than -20°C (-4°F) and less than 80°C (176°F). 2. If heat sink temperature is greater than -20°C (-4°F) and less than 70°C (158°F) then see ***ACTION 2***	1. Allow time to warm or cool depending upon temperature. 2. Replace controller.
Warning	Default Parameter	Default parameters are in place. 1. This warning is normal the first time the controller is powered up after down loading new software. 2. If not after new software download this indicates a problem with the EEPROM.	1. Cycle the key switch to 'OFF' then back to "F".	1. Replace controller.
Warning	Power Reduction	1. This warning occurs in conjunction with other motor and heat sink temperature warnings and indicates that max torque current reduction is in affect.	1. Refer to trouble shooting steps for the motor and controller temperature warning conditions.	- - -
Warning	Cur Meas Cal	1. The controller's AC current measurement system is not calibrated	No diagnostic steps	1. Replace controller
Warning	Speed Sensor	1. Sensor or wire failure	1. Check pedal functions in diagnostic real time.	1. Replace pedal sensor.
Warning	OD Current High	1. The current in an open drain output (reverse warning alarm, park brake, resistor control, solenoid or brake relay) is greater than 2.5 amps.	1. Check each output drain device (reverse warning alarm, park brake, resistor control, solenoid and brake relay) for a shorted condition, less than 0.1 ohms with the key switch turned to 'OFF'	1. If shorted condition is found replace the shorted component. 2. Replace controller.
Warning	Charger Connected	1. Battery charger is connected to the car. Driving is prohibited while charger is connected.	1. Check for charger connection to the vehicle. 2. Check charger receptacle for water ingestion or a shorted condition (is the green LED on?).	1. Disconnect the charger from vehicle. 2. Replace charger receptacle.
Warning	Brake Slipping	1.Controller has detected motor rotation while brake is engaged	1. Can occur when key switch is turned to 'OFF' while vehicle is moving. 2. Check for vehicle resistance to movement with key switch turned to 'OFF', if vehicle moves see ***ACTION 1***.	1. Replace motor brake

DIAGNOSTICS AND TROUBLESHOOTING GUIDE

R X V

CODE	DESCRIPTION	POSSIBLE CAUSES	DIAGNOSTIC STEP	ACTION (post diagnostics)
Warning	Throttle Switch Closed (Dump circuit monitoring timeout)	1. If this occurs with the key switch turned on: Throttle switch is closed at key start, the throttle switch must be opened momentarily before driving is permitted. 2. If this occurs other than immediately after the key switch is turned on: Energy dump monitoring detects energy dump circuit is continuously on for more than 30 seconds.	1. Turn key switch to 'OFF'. 2. Release throttle, check throttle switch, it should be open, if closed see ***ACTION 1***. 3. Check resistor control module (DI 2 pin 14), if shorted see ***ACTION 2***.	1. Replace throttle switch 2. Replace resistor control module. 3. Replace controller.
Warning	Brake Switch Open	1. Current in brake circuit is greater than 100 mAmps with brake energized. Controller limits drive torque current to zero in this condition.	1. Normally occurs with a panic stop. Release brake pedal. 2. Check brake switch for closed position, if open see ***ACTION 1***. 3. Check wiring for open brake circuit, if open see ***ACTION 2***.	1. Replace brake switch. 2. Replace wiring. 3. Replace controller.
Warning	BDI Low	Battery pack voltage is below 25%.	1. Check battery voltage across all 4 batteries, voltage should read 42 VDC **MINIMUM**. 3. Verify that all battery wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and battery post. 3. Verify power resistor ohm reading is between 0.2 ohms and 0.5 ohms. 4. Remove resistor control module connection to controller B- terminal, if error status changes see ***ACTION 3***.	1. Fully charge battery pack 2. Tighten or replace loose or high resistance power wire connections. 3. Replace power resistor. 4. Replace resistor control module. 5. If error continues replace controller.

2FIVE ERRORS AND CODES

CODE	DESCRIPTION	POSSIBLE CAUSES	DIAGNOSTIC STEP	ACTION (post diagnostics)
8976	AC Over Current	1. Software detects motor current 50% higher than controller peak rated current. NOTE: this error is seldom seen. It is usually the result of motor parameters such as stator inductance or resistance being out of spec. Transient Events can also cause this error without a component failure	1. Turn key to 'OFF' and then back 'ON'. If car does not run proceed to step 2. 2. Disconnect U, V, W from controller. Check resistance between U -V, V-W, and U-W, each should be 0.4-0.8 Ohms. If readings are out of range see ***ACTION 1***. If readings are in range and car does not run proceed to step 3. 3. Remove controller from the non-running car and install it in a running car, if this vehicle does not run with this controller the controller is suspect. See ***ACTION 2***	1. Replace Motor 2. Replace Controller
9024	AC Short Circuit	1. Short circuit detected in controller, motor cable or motor.	1. Turn key to 'OFF' and then back 'ON'. If car does not run proceed to step 2. 2. Disconnect U, V, W from controller. Check resistance between U -V, V-W, and U-W, each should be 0.4-0.8 Ohms. If readings are out of range see ***ACTION 1***. If readings are in range and car does not run proceed to step 3. 3. Remove controller from the non-running car and install it in a running car, if this vehicle does not run with this controller the controller is suspect. See ***ACTION 2***	1. Replace Motor 2. Replace Controller
12576	DC Bus Timeout	1. DC Bus voltage has not reached 24 volts within 10 seconds after key switch start.	1. Check battery voltage across all 4 batteries, voltage should read 42 VDC minimum, if O.K. proceed to step 2. 2. Check voltage across solenoid contacts, if more than 3 VDC but less than 24 VDC proceed to step 3, if not see ***ACTION 3***. 3. Remove resistor control module connection to controller B- terminal, if error status changes follow ***ACTION 1***.	1. Replace resistor control module. 2. If error does reoccur then replace controller. 3. Replace solenoid.
12817	DC Bus High - Software Detected	1. Battery Pack voltage is over 63 volts. NOTE: It is unlikely this error will occur in the factory. If it occurs in the field during regenerative braking, energy is transferred from the controller back to the battery pack raising the DC Bus voltage and battery pack terminal voltage only if the energy burn circuit is not properly functioning.	1. Verify that all battery wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and battery post. 2. Check the battery voltage across all 4 batteries, voltage should read 63 VDC **MAXIMUM**. 3. Check voltage across solenoid contacts. If more than 3 VDC but less than 24 VDC proceed to step 3, if it does not fall in this range follow ***ACTION 3***. 4. Verify power resistor ohm reading is between 0.2 and 0.5 ohms. 5. Remove resistor control module connection to controller B- terminal. If error status changes follow ***ACTION 1***.	1. Tighten or replace loose or high resistance power wire connections. 2. Replace power resistor. 3. Replace solenoid. 4. Replace resistor control module. 5. If error continues, replace the controller.

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CODE	DESCRIPTION	POSSIBLE CAUSES	DIAGNOSTIC STEP	ACTION (post diagnostics)
12818	DC Bus High - Hardware Detected	1. Battery Pack voltage is over 67 volts. NOTE: It is unlikely this error will occur in the factory and very rarely in the field. If it occurs in the field the most likely cause is a loose power wire or and internal controller fault	1. Verify that all battery wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and battery post. 2. Check the battery voltage across all 4 batteries, voltage should read 63 VDC **MAXIMUM**. 3. Check voltage across solenoid contacts. If more than 3 VDC but less than 24 VDC proceed to step 3, if it does not fall in this range follow ***ACTION 3***. 4. Verify power resistor ohm reading is between 0.2 and 0.5 ohms. 5. Remove resistor control module connection to controller B- terminal. If error status changes follow ***ACTION 1***.	1. Tighten or replace loose or high resistance power wire connections. 2. Replace power resistor. 3. Replace solenoid. 4. Replace resistor control module. 5. If error continues, replace the controller.
12833	DC Bus Low - Software Detected	1. Controller DC Bus voltage has dropped below 18 volts.	1. Verify that all battery wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and battery post. 2. Check the battery voltage across all 4 batteries, voltage should read 42 VDC **Minimum**. 3. Check voltage across solenoid contacts. If more than 3 VDC but less than 24 VDC proceed to step 3, if it does not fall in this range follow ***ACTION 3***. 4. Verify power resistor ohm reading is between 0.2 and 0.5 ohms. 5. Remove resistor control module connection to controller B- terminal. If error status changes follow ***ACTION 1***.	1. Tighten or replace loose or high resistance power wire connections. 2. Replace power resistor. 3. Replace solenoid. 4. Replace resistor control module. 5. If error continues, replace the controller.
16912	Motor Temp High	1. Vehicle is heavily loaded or overloaded. 2. Motor temperature of greater than or equal to 150°C (302°F), NOTE: 1300 ohms equals a motor temperature of 150°C.	1. Check external motor temperature, it should be less than 120°C (248°F). 2. Check thermocouple resistance, it should be more than 400 ohms and less than 1300 ohms. If not between these numbers perform ***ACTION 3***.	1. Allow motor to cool. 2. Reduce payload or travel grade. 3. Replace motor. 4. Replace the controller.
17168	Heat Sink Temp High	1. Vehicle is heavily loaded or overloaded. 2. Controller temperature is greater than or equal to 120°C (248°F).	1. Check the external heat sink temperature, it should be less than 80°C (176°F).	1. Allow to cool. 2. Reduce payload or travel grade. 3. Replace the controller.
20753	15V Supply Low Voltage	1. Problem with the reverse warning alarm (shorted) 2. Problem with controller's internal 15 volt supply.	1. With vehicle 'OFF', unplug 23 pin connector from the controller and measure the reverse alarm resistance, value should be between 100 ohms and 500 ohms. Perform ***ACTION 1***. 2. With vehicle 'OFF', unplug 23 pin connector from the controller and measure the relay resistance, value should be between 1 ohm and 50 ohms. Perform ***ACTION 2***.	1. Replace reverse alarm. 2. Replace controller.

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CODE	DESCRIPTION	POSSIBLE CAUSES	DIAGNOSTIC STEP	ACTION (post diagnostics)
20755	5V Supply Low or High Voltage	1. Typically caused by a short in the 5 volt wire harness. 2. Malfunction in the controller's 5 volt (sensor) supply. 3. SOC meter (if equipped) may be shorted.	1. Check both +5V and 5V GND to chassis, resistance should be more than 10k ohms, if less perform ***ACTION 1***. 2. Check throttle and brake sensor for a short condition, if shorted perform ***ACTION 2***. 3. Check motor encoder for a short condition, if shorted perform ***ACTION 3***. 4. Check SOC meter (if equipped) for a short condition, if shorted perform ***ACTION 4***.	1. Replace wire harness. 2. Replace sensor. 3. Replace encoder. 4. Replace SOC meter. 5. Replace controller.
21008	Current Sensor Offset Calibration Error	1.Error detected in controller current measurement hardware.	1. Verify that U, V and W motor wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and power post. 2.Check resistance between U-V, V-W and U-W, each should be 0.4 - 0.8 ohms.	1. Replace controller.
21520	Open Drain Outputs Current High	1. Current in an open drain output (reverse warning alarm, park brake, resistor control, solenoid or brake relay) is more than rated current.	1. Check each output drain device (reverse warning alarm, park brake, resistor control, solenoid or brake relay) for a shorted condition (less than 0.1 ohms) with the key in the 'OFF' position.	1. If shorted condition is found replace shorted component. 2. Replace controller.
25106	Direction Error	1. Occurs only when the reverse and forward signals are simultaneously selected (normally a short condition in either the key switch or wiring)	1. Remove key switch, with switch in 'FWD' and check A-C and A-D, either A-C or A-D when tested should read less than 0.1 ohms, NOT BOTH. 2. Repeat step 1 with switch in 'REV', if step 1 or 2 fail see ***ACTION 1***. 3. Remove 23 pin connector form controller, check mating connector to key switch, pin C and D for a reading of less than 0.1 ohms, if over 0.1 ohms see ***ACTION 2***. 4. If steps 1 - 3 check out good then see ***ACTION 3***.	1. Replace key switch. 2. Replace wiring harness 3. Replace controller.
25105	Throttle Sensor Error	1. Throttle position sensor has a low voltage condition, less than 0.35 volts. 2. Throttle position sensor has a high voltage condition, greater than 4.8 volts. 3. Throttle position sensor has a voltage less than 0.85 volts when throttle switch closes.	1. Verify that the 5 volt out put range is 5 volts ±0.1 volts. 2. Turn key switch to 'N' and place that the accelerator pedal is in the upright position. 3. Verify that accelerator pedal arm is in contact with the rubber bumper, if not in contact with bumper see ***ACTION 1***. 4. Verify the throttle sensor voltage is between 0.35 volts and 4.8 volts. If not in range see ***ACTION 2***. 5. Verify the throttle sensor voltage is less than or equal to 0.85 volts when throttle switch closes. If greater than 0.85 volts see ***ACTION 3***. 6. Verify other 5 volt supply devices; motor encoder, resistor module and brake sensor. 7. If diagnostic steps 1 and 3-6 fail see ***ACTION 5***.	1. Remove obstruction. 2. Replace throttle sensor. 3. Replace throttle switch. 4. Repair or replace bad device. 5. Replace controller.
25107	Brake Current Low	1. Open circuit, harness not connected. 2. Brake failure	1. Check for loose connection or open circuit in motor brake harness.	1. Tighten or replace harness. 2. Rplace motor brake. 3. Replace controller.

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CODE	DESCRIPTION	POSSIBLE CAUSES	DIAGNOSTIC STEP	ACTION (post diagnostics)
25108	Brake Sensor Error	Brake position sensor input is out of range, there are three conditions which can cause this error. 1. Low sensor voltage, less than 0.35 volts. 2. High sensor voltage, greater than 4.8 volts. 3. Sensor voltage greater than 0.85 volts when brake switch closes.	1. Verify that the 5 volt out put range is 5 ±0.1 volts. 2. Turn key switch to 'N' and check that the accelerator pedal is in the upright position. 3. Verify that accelerator pedal arm is in contact with the rubber bumper, if not in contact with bumper see ***ACTION 1***. 4. Verify the throttle sensor voltage is between 0.35 volts and 4.8 volts. If not in range see ***ACTION 2***. 5. Verify the throttle sensor voltage is less than or equal to 0.85 volts when throttle switch closes. If greater than 0.85 volts see ***ACTION 3***. 6. Verify other 5 volt supply devices; motor encoder, resistor module and brake sensor.	1. Remove obstruction. 2. Replace throttle sensor. 3. Replace throttle switch. 4. Repair or replace bad device.
33024	CAN Timeout	1. This error occurs when the controller and the handled devices stop communicating.	1. Check for a loose handheld connection or a damaged handheld. Replace the CAN Bus plug (run plug).	1. Cycle the key switch (turn it off then back on). 2. Depress accelerator pedal, release and depress again.
Warning	Drive Fault	1. Indicates the current error is the result of a condition internal to the controller. The message can appear in combination with one of the above error messages.	1. Trouble shoot according to the controller error message displayed.	1. Replace motor controller
Warning	DC Bus Low	DC Bus voltage is less than 24 volts.	1. Verify that all battery wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and battery post. 2. Check the battery voltage across all 4 batteries, voltage should read 42 VDC **MINIMUM**. 3. Check voltage across solenoid contacts. If more than 3 VDC but less than 24 VDC proceed to step 3, if it does not fall in this range follow ***ACTION 3***. 4. Verify power resistor ohm reading is between 0.2 and 0.5 ohms.	1. Tighten or replace loose or high resistance power wire connections. 2. Replace power resistor. 3. Replace solenoid. 4. If error continues, replace the controller.
Warning	DC Bus High	Controller DC Bus voltage is greater than 67 volts.	1. Verify that all battery wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and battery post. 2. Check the battery voltage across all 4 batteries, voltage should read 63 VDC **MAXIMUM**. 3. Check voltage across solenoid contacts. If more than 3 VDC but less than 24 VDC proceed to step 3, if it does not fall in this range follow ***ACTION 3***.	1. Tighten or replace loose or high resistance power wire connections. 2. Replace power resistor. 3. Replace solenoid. 4. If error continues, replace the controller.

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CODE	DESCRIPTION	POSSIBLE CAUSES	DIAGNOSTIC STEP	ACTION (post diagnostics)
Warning (Speedometer code 1004)	BDI Calibration	1. The DC Bus measurement system is not calibrated.	no diagnostic steps to perform	1. Replace the controller
Warning (Speedometer code 1001)	Motor Temp High	1. Measured motor temperature is greater than 140°C (284°F) but less than 150°C (302°F). Linear torque current reduction is active, drivability is affected (reduced speed).	1. Check external motor temperature, should be less than 120°C (248°F). 2. Check thermocouple resistance, should be more than 400 ohms and less than 1300 ohms, if out of range perform ***ACTION 3***.	1. Allow time to cool. 2. Reduce payload or driving grade. 3. Replace motor. 4. Replace controller.
Warning (Speedometer code 1003)	Motor Temp Sensor	1. Motor temperature sensor is shorted or not connected.	1. Check external motor temperature, should be less than 120°C (248°F). 2. Check thermocouple resistance, should be more than 400 ohms and less than 1300 ohms, if out of range perform ***ACTION 3***.	1. Allow time to cool. 2. Reduce payload or driving grade. 3. Replace motor. 4. Replace controller.
Warning	Heat Sink Temp Low	1. Controller heat sink temperature is less than -20°C (-4°F). Max torque current reduction is active, drivability is affected. This condition normally goes away after a few minutes of operation when the heat sink warms up to a temperature greater than -20°C (-4°F).	1. Check external heat sink temperature, it should be more than -20°C (-4°F). 2. If heat sink temperature is greater than -20°C (-4°F) then see ***ACTION 2***.	1. Warm vehicle to greater than -20°C (-4°F). 2. Replace controller.
Warning (Speedometer code 1005)	Heat Sink Temp High	1. Measured heat sink temperature is greater than 85°C (185°F) but less than 115°C (239°F), linear torque current reduction is active, drivability is affected.	1. Check external heat sink temperature, should be less than 80°C (176°F).	1. Allow time to cool. 2. Reduce payload or driving grade. 3. Replace controller.
Warning	Heat Sink Temp Sens	1. Heat sink temperature sensor shorted or not connected.	1. Check external heat sink temperature, it should be more than -20°C (-4°F) and less than 80°C (176°F). 2. If heat sink temperature is greater than -20°C (-4°F) and less than 70°C (158°F) then see ***ACTION 2***	1. Allow time to warm or cool depending upon temperature. 2. Replace controller.
Warning	Default Parameter	Default parameters are in place. 1. This warning is normal the first time the controller is powered up after down loading new software. 2. If not after new software download this indicates a problem with the EEPROM.	1. Cycle the key switch to 'OFF' then back to "F".	1. Replace controller.
Warning	Power Reduction	1. This warning occurs in conjunction with other motor and heat sink temperature warnings and indicates that max torque current reduction is in affect.	1. Refer to trouble shooting steps for the motor and controller temperature warning conditions.	- - -
Warning	Cur Meas Cal	1. The controller's AC current measurement system is not calibrated	No diagnostic steps	1. Replace controller

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CODE	DESCRIPTION	POSSIBLE CAUSES	DIAGNOSTIC STEP	ACTION (post diagnostics)
Warning (Speedometer code 1002)	Speed Sensor	1. Sensor or wire failure	1. Check pedal functions in diagnostic real time.	1. Replace pedal sensor.
Warning	OD Current High	1. The current in an open drain output (reverse warning alarm, park brake, resistor control, solenoid or brake relay) is greater than 2.5 amps.	1. Check each output drain device (reverse warning alarm, park brake, resistor control, solenoid and brake relay) for a shorted condition, less than 0.1 ohms with the key switch turned to 'OFF'	1. If shorted condition is found replace the shorted component. 2. Replace controller.
Warning (Speedometer code 1006)	Charger Connected	1. Battery charger is connected to the car. Driving is prohibited while charger is connected.	1. Check for charger connection to the vehicle. 2. Check charger receptacle for water ingestion or a shorted condition (is the green LED on?).	1. Disconnect the charger from vehicle. 2. Replace charger receptacle.
Warning (Speedometer code 1000)	Brake Slipping	1.Controller has detected motor rotation while brake is engaged	1. Can occur when key switch is turned to 'OFF' while vehicle is moving. 2. Check for vehicle resistance to movement with key switch turned to 'OFF', if vehicle moves see ***ACTION 1***.	1. Replace motor brake
Warning (Speedometer code 1007)	Throttle Switch Closed	1. If this occurs with the key switch turned on: Throttle switch is closed at key start, the throttle switch must be opened momentarily before driving is permitted.	1. Turn key switch to 'OFF'. 2. Release throttle, check throttle switch, it should be open, if closed see ***ACTION 1***.	1. Replace throttle switch 2. Replace controller.
Warning	BDI Low	Battery pack voltage is below 25%.	1. Check battery voltage across all 4 batteries, voltage should read 42 VDC **MINIMUM**. 3. Verify that all battery wires are securely fastened and have less than 0.1 ohms resistance between wire terminal and battery post.	1. Fully charge battery pack 2. Tighten or replace loose or high resistance power wire connections. 3. If error continues replace controller.
Warning (Speedometer code 1008)	Reverse Alarm Test Failed	1. Reverse warning alarm failed at startup check. The controller tests for a completed reverse warning alarm circuit.	1. Turn key switch to 'OFF' and unplug 23 pin connector from controller. 2. Check the reverse warning alarm for a shorted condition, less than 0.1 ohms, by measuring between pin 10 and pin 13 with the Run/Tow switch in the 'TOW' position. If test is greater than 0.1 ohms see ***ACTION 1***. 3. Turn key switch to 'R' and verify voltage to the reverse warning alarm is 48 volts, if not then see ***ACTION 2***.	1. Replace reverse warning alarm. 2. Replace wiring 3. Replace controller