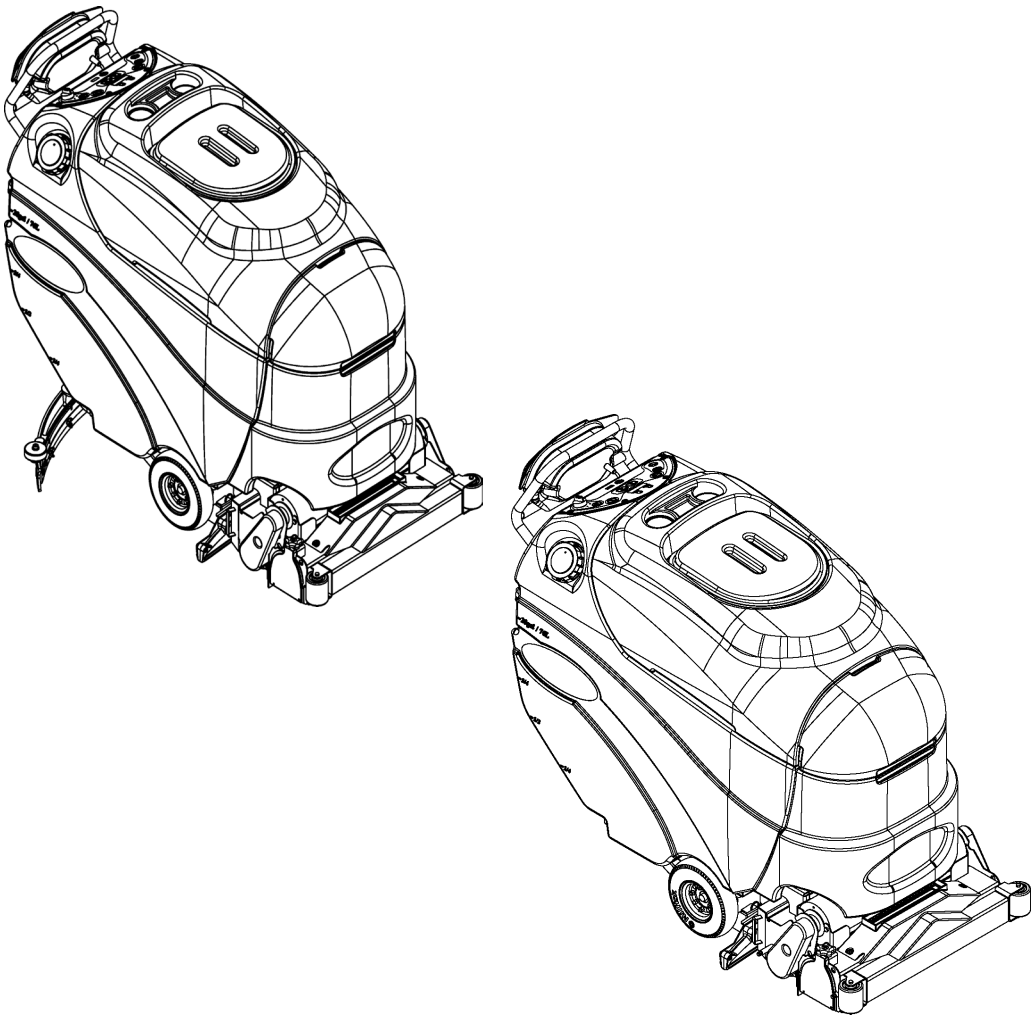
Adphibian™/AX 651 Multi EDS AquaPLUS™



Service Manual

Advance Adphibian Model 56317000
Nilfisk AX 651 Multi EDS Model 56317003
Advance AquaPLUS Models 56317001, 56317002

Nilfisk Advance

11/10 Form No. 56043116

General Maintenance

Maintenance Schedule

Maintenance intervals given are for average operating conditions. Machines used in severe operational environments may require service more often.

Maintenance Item	Daily	Weekly	Monthly	Yearly
Charge Batteries	X			
Check/Clean Tanks and Hoses (clean recovery tank switches and vacuum inlet screen)	X			
Check/Clean/Rotate the Brushes	X			
Check/Clean the Squeegee (Adphibian/AX 651 only)	X			
Clean Hopper on Cylindrical System	X			
Purge Extended Scrub System (if installed)	X			
Purge AXP Detergent System (if installed)		X		
Check the Water Level on each Battery Cell (does not apply to gel cell batteries)		X		
Inspect Scrub Housing Skirts		X		
Inspect and clean Solution Filter		X		
Clean Solution Trough on Cylindrical System		X		
Lubricate the Machine			X	
* Check the Carbon Brushes				X

Note: *See the individual machine system sections for maintenance information.*

* Have Nilfisk-Advance check the vacuum motor carbon brushes once a year or after 300 operating hours. Check the brush motor and drive motor carbon brushes every 500 hours or once a year.

Warning!

Turn the Key Switch off and disconnect the batteries before servicing the machine.

- Check the vacuum motor carbon brushes once a year or after 300 operating hours.
- Check brush and wheel drive motor(s) carbon brushes (four per motor) once a year or after 500 operating hours.
- The original (new) length of each carbon brush is 1” (25,4mm) on all 24-volt machine models brush and wheel drive motors.
- Replace the carbon brushes on all motors when the brushes are shorter than 3/8” (9.5mm) to obtain the same motor efficiency as new brushes.

Important!

Motor damage resulting from failure to service the carbon brushes is not covered under warranty. See the ***Limited Warranty Statement***.

- The detergent system will be enabled.
- The travel speed will be variable from 20% to 100%.
- As soon as the throttle is moved from the neutral position, the scrub brushes will start turning and the vacuum will turn on. If the direction is forward, the solution flow will start. If the direction is reverse, the solution flow will be stopped.
- The Heavy Scrub Pressure Indicator (**D16**) will indicate the heavy scrub pressure setting by showing the scrub pressure icon with a full gauge next to it.

Floor Mode Switch (K)

If the scrub system is off, pressing this switch will:

- If in extract mode, a warning screen will be displayed notifying the operator to move vacuum hose from the extraction/vacuum shoe port to the squeegee port. After 10 seconds or another press of the Mode Select switch, the machine will enter hard floor scrub mode.
- If in hard floor scrub mode, a warning screen will be displayed notifying the operator to move vacuum hose from the squeegee port to the extraction/vacuum shoe port. After 10 seconds or another press of the Mode Select switch, the machine will enter extract mode.
- The Scrub Mode Indicator (**D12**) will be off if the machine is in the extract mode, green if in the hard floor scrub mode and yellow if transitioning from one mode to the other.

Control Panel Indicators - Adphibian/AX 651 Multi EDS

AXP Indicator (D1)

Machines equipped with an AXP system have an AXP indicator in the lower left corner of the display. When AXP is enabled, the indicator will show a detergent bottle icon. When AXP is disabled, the detergent bottle icon will have a cross through it. If the operator chooses a specific mix ratio on the AXP bottle, it will be displayed in the **AXP Detergent Ratio Indicator (D4)** to the right of the AXP Indicator.

Hour Meter (D2)

The hour meter is shown in the upper left corner of the display for five seconds after the machine is turned on. The hour meter displays the total time spent scrubbing for the life of the machine.

Battery Indicator (D2)

After five seconds of operation, the battery condition indicator replaces the hour meter in the upper left corner of the display. It gives a relative indication of the state of charge of the battery pack. A fully-charged battery pack will measure above 25.1 volts with no load applied (2.09 volts per cell). The Adphibian/AX 651 Multi EDS is equipped with a low-voltage cutout feature that will turn the scrub system off when the batteries are discharged to their minimum level. There are two different cutout levels to accommodate different battery types. (See the ***Electrical System/Main Control Board Special Program Options*** section for details.) The voltage levels for the various indications are as follows (the voltages shown represent the voltage under load):

Note: *See the **Control Panel Switch Functions** sections in this manual for a complete explanation of the solution operation modes.*

During normal machine scrubbing the solution system's Auto Mode is selected and works in conjunction with the wheel drive speed controller and the (A1) main controller's scrub system outputs to turn solenoid valves L1 and L2 and solution pump M1 on and off. The solution will flow to the nozzle(s) when the scrub deck is lowered and the handle drive paddle is pushed forward. Note that when the detergent system switch is off, no flow can occur while the machine scrub deck is down and the drive paddle activated.

See the detailed drawings shown in the ***Control Panels*** section for the specific description of the individual icon symbols.

Note: *If a speed control fault occurs (error code 3) the wand indicator will flash the fault code produced by the Curtis speed control. Refer to the **Electrical/Curtis Controller Diagnostics** section for details.*

Circuit Overview - Solution Auto Mode (Solenoid Valve Circuit)

See Figure 6.

In order for the solution to flow to the nozzles, the

+ (Positive) circuit input starts with:

A closed S1 Key Switch that will direct the needed positive voltage (BRN wires) to the L1 and L2 solenoid coils, pin #5 - KSI on the A2 Speed Controller and pin #J2-8 on the A1 Control Board.

- (Negative) circuit input starts with:

- Battery negative ground inputs at the A1 Control Board and A2 Speed Control Ground terminals.
- The A1 control board solution button enabled.
- A negative voltage output from the A2 speed controller's (pin #6) RED/BLK wire to the A1 control board RED/BLK wire (terminal J1-5). Note that the A2 speed control Brake output (pin #6) occurs whenever the R1 direction throttle pot is moved off its neutral setting.
- Negative voltage outputs from the A1 board terminals J1-2 RED/GRN wire and J1-4 YEL/GRN wire to the L1 and L2 solenoid coils respectively, actuating the solenoids to allow flow through the valve bodies.

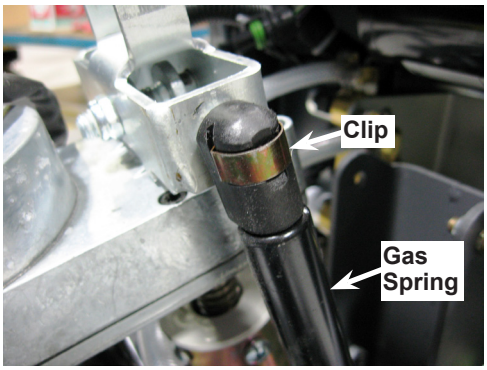
Circuit Overview - Solution Auto Mode (Solution Pump Circuit)

See Figure 6.

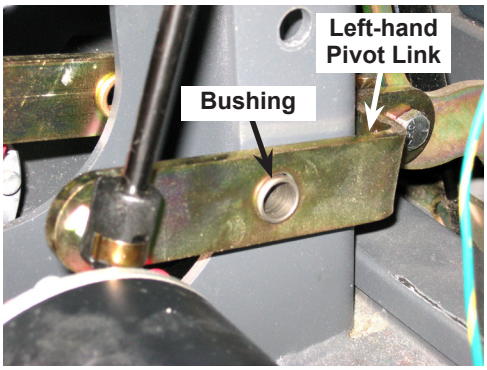
+ (Positive) circuit input starts with:

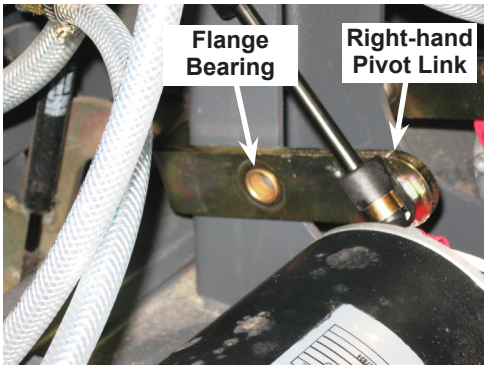
A closed S1 Key Switch will direct the needed positive voltage (BRN wires) to the M1 Solution Pump, pin #5 - KSI on the A2 Speed Controller and pin J2-8 on the A1 Control Board.

13. Remove the Clips holding the Gas Springs to the Actuator Yoke, then remove the actuator assembly from the machine.

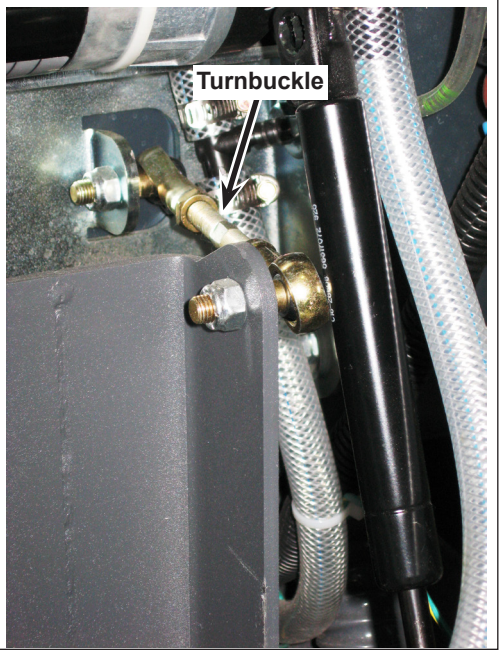


14. Disconnect the two Pivot Links from the deck weldment. Note that there is a Bushing in the Left-hand Pivot Link and a Flange Bearing in the Right-hand Pivot Link (as viewed from the operator position).





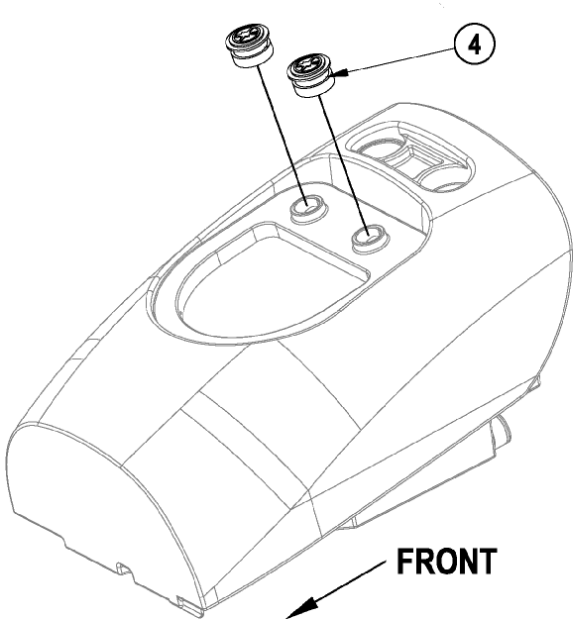
15. Disconnect the Turnbuckle from the deck weldment.



Maintenance of the Vacuum Motor Inlet Screens

The two Vacuum Motor Inlet Screens **(4)** should be cleaned on a daily basis. DO NOT run water down the screens in an attempt to clean them. If you do this you will be running water directly into the vacuum motors. Remove the Screens (4) from the machine to clean them, then reinstall.

Figure 13



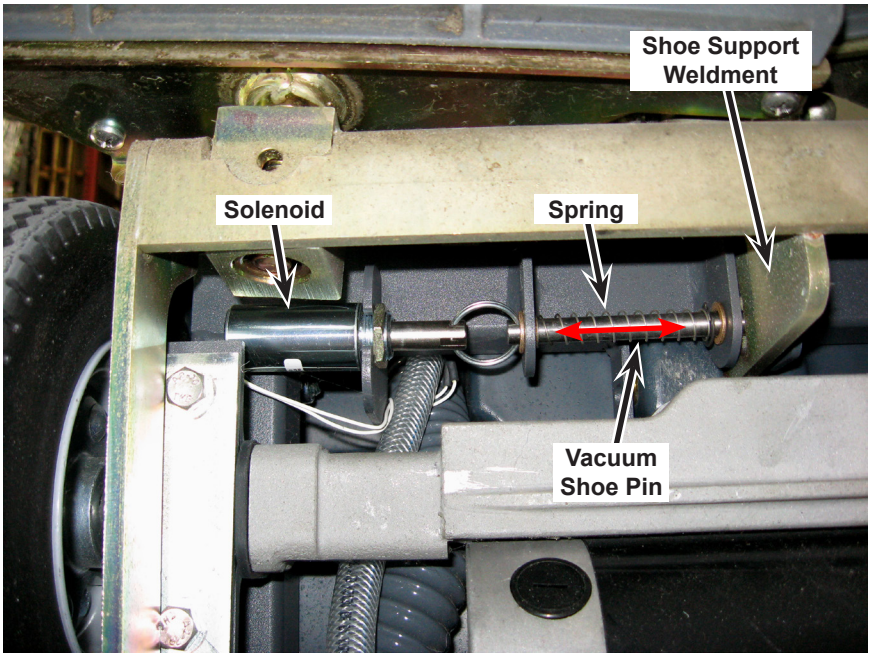
Spray Nozzle Maintenance

Remove the spray nozzles once a week. Soak the nozzles overnight in a vinegar and water solution to remove any chemical deposits.

Vacuum Shoe Pin - (Adphibian and AX 651 Multi EDS Only)

- When the scrub deck is lowered in the extract mode, the Solenoid retracts the Vacuum Shoe Pin (latch rod) from the Shoe Support Weldment to allow the vacuum shoes to extend downward with the scrub deck. Once the deck and shoes are down, the Solenoid releases the Pin and the Spring returns the Pin to the extended position. When the scrub deck and vacuum shoes are raised, the Pin re-engages the Shoe Support Weldment.
- When the scrub deck is lowered in the scrub mode, the Solenoid does not retract the Vacuum Shoe Pin from the Shoe Support Weldment. The Pin holds the Vacuum Shoes in the upward (retracted) position.

Make sure to keep the Vacuum Shoe Pin, Spring and flange bearings clean and free of debris so the Pin can cycle in and out normally.



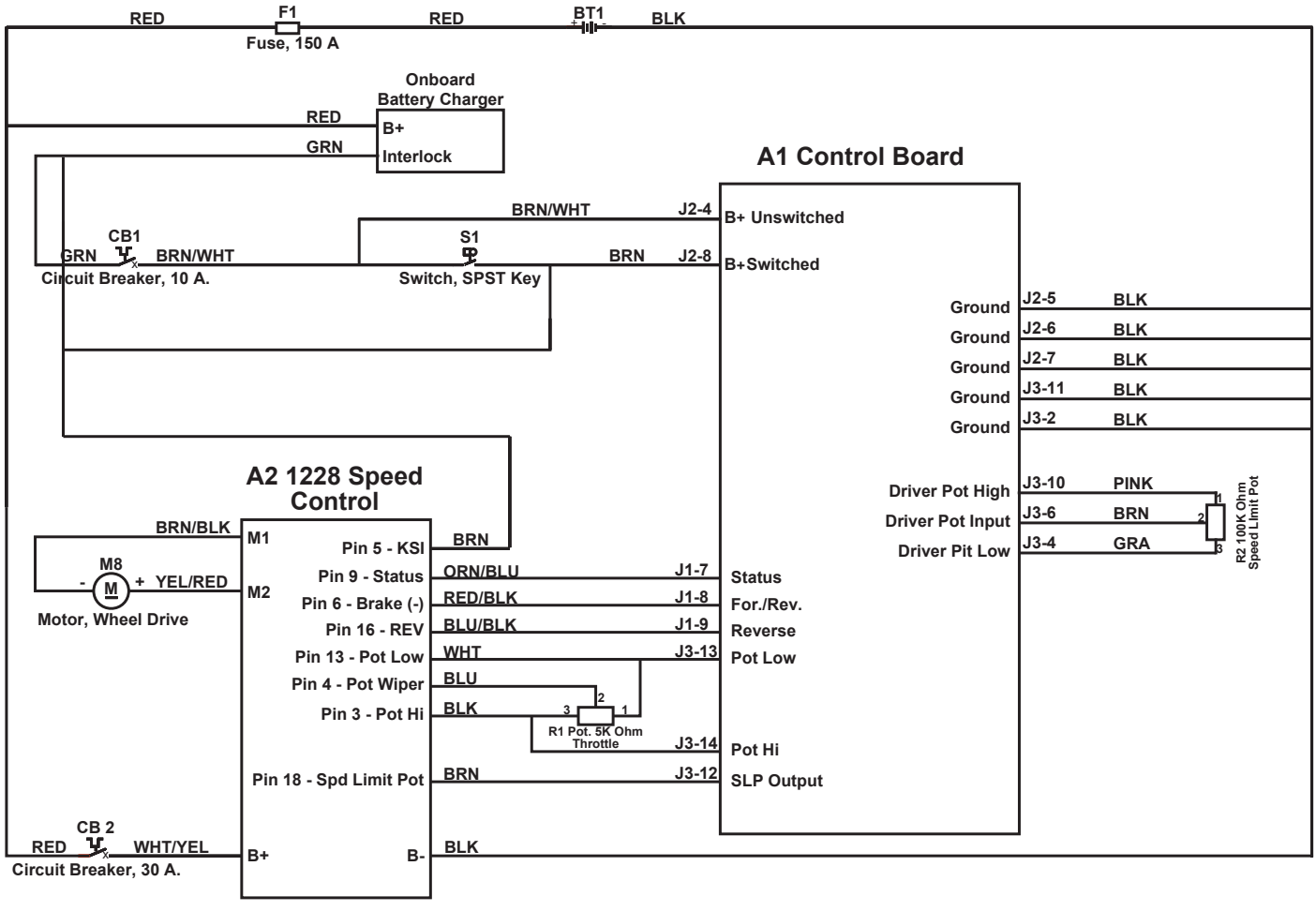
Drive Motor System Function

See Figures 21 and 22. With the Key Switch S1 closed, the BRN wire inputs 24V to the A2 speed controller (pin 5-KSI) to make its internal control circuits operational (powering it up). The CB2 circuit breaker (30-Amp) supplies the positive load circuit voltage input to the B+ controller terminal (WHT/YEL wire). The black wire from the battery negative standoff supplies the negative input to the B- controller terminal.

Moving the 5K Ohm R1 pot off its centered balanced neutral setting of approximately 2500 Ohms, activates the operator input to the speed control. Forward or Reverse movement of the drive paddle rotates the pot shaft, and the pot's variable resistance values are changed which generates the internal voltage signals (0-5 Volts) needed for the controller's output operation. These control board voltage input signals are what energizes the Forward and Reverse directional relays, which then select the motor polarity and final voltage level outputs at the M1 and M2 terminals.

When the operator turns the R2 speed limit Pot from min. to max. (CW) this causes an input resistance relationship change between the pot high (+) and wiper terminals (high to low Ohms), thus increasing the maximum wheel motor operating speed range. Turning the knob (CCW) increases the resistance and the motor speed range is reduced.

Figure 21



Electrical Diagram

*For a complete description of all callouts see the ***Electrical Wiring Diagram/Schematic***.

Caution!

Electrical components in this machine can be severely damaged if the batteries are not installed and connected correctly. An Advance technician, a qualified electrician or the battery manufacturer should install batteries.

1. Remove the batteries from their shipping crate and carefully inspect them for cracks or other damage. If damage is evident, contact the carrier that delivered them or the battery manufacturer to file a damage claim.
2. Turn the Key Switch **(A)** off and remove the key.
3. Tip the recovery tank to the side, locked position. Remove the battery cables from inside the battery compartment.
4. Your machine comes from the factory with enough battery cables to install four 6-volt batteries. Carefully lift the batteries into the battery compartment and arrange them exactly as shown in Figure 30. Secure the batteries as close to the back of the machine as possible.
5. Install the battery cables as shown. Position the cables so the battery caps can be removed easily for battery service.
6. Carefully tighten the nut in each battery terminal until the terminal will not turn. Do not overtighten the terminals or they will be very difficult to remove for future service.
7. Coat the terminals with spray-on battery terminal coating (available at most auto parts stores).
8. Put one of the black rubber boots over each of the terminals and connect the Battery Pack Connector (**17**).

Specific Wet Cell Battery Information

Wet Cell Battery Specifications

- Use a combination of multiple 2-volt cell units to construct a 24-volt DC battery pack system.
- The battery pack capacity recommended by Nilfisk-Advance is a 238 AH @ 20 Hour Rate deep cycle battery system.

Note: *The battery pack must fit the battery compartment as listed in the* ***Technical Specifications****.*

Wet Cell Battery Charger Specifications

- Use a 24-volt DC output charger matching the DC battery pack voltage and the input AC line voltage supply being used.
- When selecting a battery charger always follow the recommendation of the battery supplier to match the correct charger DC output amperage to the amp/hour rating batteries being installed. This will prevent the battery pack from being over or under charged.
- The recommended 238 AH battery should be matched to a 24V, 25 Amp output charger on machines using (4) 6V batteries.

Status LED Fault Codes (Table 1)			
LED Code	Status Light Display	Explanation	Possible Cause
1,1	0 0	over-/under-temperature cutback	1. Temperature >92°C or < -25°C. 2. Excessive load on vehicle 3. Operation in extreme environments. 4. Electromagnetic brake not releasing.
1,2	0 00	throttle fault	1. Throttle input wire open or shorted 2. Throttle pot defective. 3. Wrong throttle type selected.
1,3	0 000	speed limit pot fault	1. Speed limit pot wire(s) broken or shorted. 2. Broken speed limit pot.
1,4	0 0000	battery voltage too low	1. Battery voltage <17 volts. 2. Bad connection at battery or controller.
1,5	0 00000	battery voltage too high	1. Battery voltage >36 volts. 2. Vehicle operating with charger attached. 3. Intermittent battery connection.
2,1	00 0	main contactor driver Off fault	1. Main contactor driver failed open.
2,3	00 000	main contactor fault	1. Main contactor welded or stuck open. 2. Main contactor driver fault. 3. Brake coil resistance too high.
2,4	00 0000	main contactor driver On fault	1. Main contactor driver failed closed.
3,1	000 0	fault present for >10 sec.	1. Misadjusted throttle. 2. Broken throttle pot or throttle mechanism.
3,2	000 00	brake On fault	1. Electromagnetic brake driver shorted. 2. Electromagnetic brake coil open.
3,3	000 000	pre-charge fault	1. Low battery voltage. 2. KSI and throttle turned on at same time.
3,4	000 0000	brake Off fault	1. Electromagnetic brake driver open. 2. Electromagnetic brake coil shorted.
3,5	000 00000	HPD (High Pedal Disable) fault	1. Incorrect sequence of throttle and KSI,** push, or inhibit inputs. 2. Misadjusted throttle pot.
4,1	0000 O	current sense fault	1. Short in motor or in motor wiring. 2. Controller failure. *
4,2	0000 00	motor voltage fault (hardware fail-safe)	1. Motor voltage does not correspond to throttle request. 2. Short in motor or in motor wiring. 3. Controller failure. *
4,3	0000 000	EEPROM fault	1. EEPROM failure or fault.
4,4	0000 0000	power section fault	1. EEPROM failure or fault. 2. Short in motor or in motor wiring. 3. Controller failure. *

* Jack up vehicle and retest to confirm diagnosis. Clean the connections, inspect system wiring, then retest.

**Note: A KSI (Key Switch Input) system problem is a specific HPD (high pedal disable) type operational fault caused by the operator activating the Forward/Reverse drive paddle before turning on the main Key Switch. This can be cleared by returning the operator's drive paddle to neutral, then cycling the Key Switch OFF and ON.