The Boar Bot

Owner's Manual

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SwineRobotics.com

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OWNER'S MANUAL

Overview

The Boar Bot is a remote controlled steerable vehicle powered by 2 rechargeable 12 volt deep cycle batteries connected to operate as a 24 volt system. A set of wheels on each side of the vehicle are separately powered to permit steering of the vehicle. The power source, drive motors, and receiver are encased within the housing assembly. An opaque protection screen is used to permit safe release of the boar from the vehicle.

Options and accessories

The Boar Bot is available in several options--

- Single speed Boar
- 2.0 Variable speed Boar Bot for faster transport between places & smoother operation.
- Single speed Boar Bot narrow version for narrower alleys.

The Boar Bot can be fitted with several accessories—

- Hearse with power winch for ease in removing dead carcasses
- Side shields to limit the boars visibility
- Lead boar harness to add the capability of attaching two boars

Specifications

Mode of operation- remote controlled

Weight—over 500 lbs

Power Source— 2 – 12 volt deep cycle batteries

-24volts single speed Boar Bot and 2.0 variable two speed Boar Bot

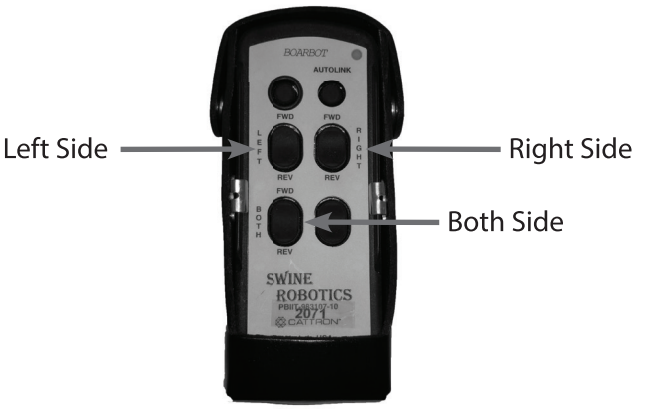
Operating time—over 8 hours continuous use

Operating the Boar Bot

No one under the age of eighteen should operate a Boar Bot!

Remote control

The remote control for the Boar Bot has three switches capable of performing six functions. The two top switches control each side of the Boar Bot independently in the forward and reverse direction. The bottom switch controls both sides of the Boar Bot allowing straight forward or reverse operation.



Power switch

The power switch which is a rocker switch is located on the top of the Boar Bot near the front left corner. **Always turn off the switch when the Boar Bot is not in use.**

Battery charger

The Boar Bot is shipped with an external battery charger with automatic shutdown to avoid overcharging the batteries. The charger receptacle is located on the top of the Boar Bot near the front left corner. Because the charger has a low ampere rating, it may take several days to fully charge a dead battery. **Connect the battery charger whenever the Boar Bot is not in use!**

Boar harness

The boar is attached to the Boar Bot with a harness. The boar harness is easy to adjust to fit any size adult animal. When training the boar to be lead by the Boar Bot, firmly tighten the harness to the boar.

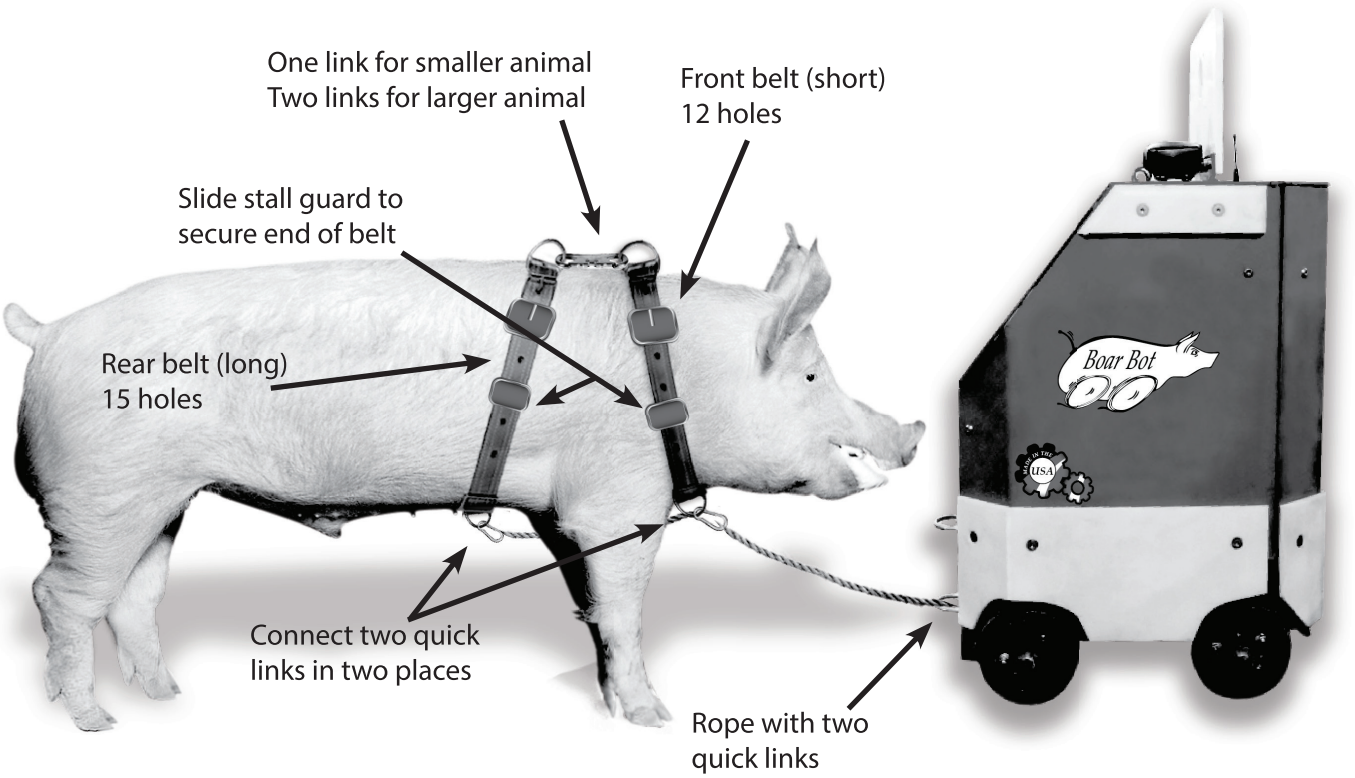


Figure 1
Boar harness properly attached to boar and boar properly attached to Boar Bot

Boar attached to Boar Bot

The boar must be pulled from the bottom U-bolt in the rear plate of the Boar Bot. **Attaching the boar to another location on the machine may result in overturning the Boar Bot!** Loop the rope through the bottom U-bolt attached to the rear plate and up to the slot in the top vision guard. A series of knots in the rope can be used to pull the boar closer to the Boar Bot. Advance the knots in the rope through the keyhole slot in the top vision guard until the boar is hooked at the desired length.

READ AND UNDERSTAND THE OPERATIONS MANUAL BEFORE USING THE BOAR BOT!!

Warranty

Swine Robotics, Inc. will replace any part found to be defective in workmanship within the first year of purchase. The warranty covers the cost of the replacement part, but does not cover the shipping or labor costs associated with the removal and installation of the defective part.

The factory installed batteries carry a two (2) year warranty. Batteries found to be defective within one year from the original purchase date will be replaced. Batteries found to be defective within the second year from original purchase date will be replaced at a pro-rated cost. *Do not return batteries under warranty to Swine Robotics: contact the nearest Delco battery dealer with battery warranty issues.*

Service and Parts

For parts and technical support, contact your local distributor or
Swine Robotics, Inc. at **(605)439-3510.**
Please return parts under warranty to the following address

Swine Robotics, Inc.
748 Sherman St
Leola, SD 57456
USA

Maintenance

The Boar Bot has been designed to give you many hours of trouble free service with a minimum of maintenance. To help extend the life of your machine and to keep it operating smoothly the following maintenance should be performed.

1. Grease the wheels--MONTHLY

The wheels can be greased with a standard grease gun. The grease zerks are located on the outside of the wheels near the hub. ***Under extreme conditions it may be necessary to grease the wheels more often***

2. Clean the battery connections--MONTHLY

To reduce battery terminal corrosion, the battery terminals need to be cleaned. Turn the power switch to the "OFF" position. Remove the terminal connections from the batteries. Remove the corrosion from the battery terminals using emery paper or a wire brush. Reconnect the wire terminals and apply anticorrosion grease or spray. ***Under extreme conditions it may be necessary to clean the battery terminals more often.***

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3. Check the chain tension--MONTHLY

Support the machine with a hoist or blocks to suspend the wheels off the floor. If supporting with a chain hoist, lift from the U-bolt on the top of the machine. With the wheels suspended, run the machine so the chain slack is on the bottom portion of the chain. Turn the power switch to the "OFF" position and disconnect the negative battery terminal on the rear battery. Loosen the idler sprocket with a ¾ inch wrench and slide the sprocket up to snug the chain. If the idler sprocket can not be moved to tighten the chain, it maybe necessary to remove the offset link or a link from the chain. Proper chain tension will allow you to move the slack side of the chain about ½ inch
The chain should be snug but not extremely tight. Over tightening the chain will shorten the life of the drive components.

4. Oil the drive chains--MONTHLY

Turn the power switch to the "OFF" position. Open both the front and rear doors. Lubricate the drive chains using a spray type chain lubricant. ***Under extreme conditions it may be necessary to lubricate the chains more often.***

5. Check gear box oil level--YEARLY

Turn the power switch to the “OFF” position. Open the rear door and remove the rear battery. Remove the gearbox oil plug through the access hole in the gearbox mounting bracket. The oil level of each gearbox should be at the bottom of the plug hole. If the oil level is low, fill the gearbox with 80W90 gear oil to the oil plug l Tighten the plugs and reinstall the rear battery. ***Do not remove the low oil plug. Filling the gearbox only to the low oil plug level will result in severe gearbox damage***

Trouble shooting

1. Machine does not move

Possible Cause	Check/Repair
Receiver fuse is blown	Check fuse and replace with a 3 amp fuse if necessary
Corrosion on battery connections	Clean battery connections as outlined in the Maintenance section
Discharged or faulty batteries	Charge or replace batteries as necessary.
Loose wire in electrical box	Check connections in electrical box
Battery charger not properly attached	Check if the charger receptacle wires are connected to batteries.
Faulty power switch	Check power switch. Refer to Electrical service-Checking the power switch.

Faulty remote control	Check remote control. Refer to Electrical service- Checking the remote control.
Faulty receiver	Check receiver. Refer to Electrical service- Checking the receiver unit inside the Boar Bot.

2. Wheels on one side of the Boar Bot do not turn

Possible Cause	Check/Repair
30 Amp circuit breaker blown	Check and reset circuit breaker.
Corrosion on battery connections	Clean battery connection as outlined in the maintenance section.
Discharged or faulty batteries	Charge or replace batteries.
Loose wire in junction box	Check connections in electrical box.
Battery charger not properly attached	Check if the charger receptacle wires are connected to batteries.
Loose or broken drive chain	Tighten or replace chain.
Faulty remote control	Check remote control. Refer to Electrical service- Checking the Remote Control
Faulty receiver	Check receiver. Refer to Electrical service-Checking the receiver unit inside the Boar Bot.
Faulty solenoid	Check solenoids. Refer to Electrical service-Checking the solenoids.

Faulty motor	Check motor. Refer to Electrical service-Checking the drive motor.

3. Motor runs but wheels do not turn.

Possible Cause	Check/Repair
Loose or broken drive chain	Tighten or replace chain.
Worn sprockets	Replace sprockets if sprockets have excessive wear.
Sheared key on gearbox sprocket	Replace key, if key is sheared.
Sheared key on motor driveshaft.	Remove motor and replace key if key is sheared.
Faulty gearbox	Check that the gearbox output shaft is not turning when motor is running. Replace gearbox.

4. Drive chains do not stay on sprockets.

Possible Cause	Check/Repair
Improper chain tension	Adjust chain tension with idler sprocket.
Worn wheel bushings	Replace bushings if bushings have excessive wear.
Worn axle shaft	Replace axle shaft if axle has excessive wear.
Bent axle shaft	Replace axle if bent.

5. Batteries do not charge or maintain a charge

Possible Cause	Check/Repair
Corroded battery connections	Clean battery connections.
Charger not plugged in correctly	Properly attach charger plug.
Charger receptacle not attached to battery	Inspect wires from battery charger receptacle to the batteries.
Faulty battery charger	Check for faulty battery charger. Refer to Electrical service-Checking the battery charger.
Faulty batteries	Check batteries with digital voltmeter or battery tester. Refer to Electrical service-Testing the individual batteries.

6. Erratic operation.

Possible Cause	Check/Repair
Low remote control batteries	If voltage is less than 1.3 volts per battery, replace remote control batteries.
Low main battery voltage	Check for low voltage. Refer to Checking for low voltage symptoms.
Faulty 12-volt main battery	Replace battery.
Faulty antenna lead	Inspect antenna lead. Replace if faulty.

Faulty remote control	Verify if remote control is functioning. Replace if faulty.
Faulty receiver	Replace if faulty. Refer to Electrical service-Checking the receiver unit inside Boar Bot.

7. Clicking noise coming from the machine

Possible Cause	Check/Repair
Improper chain tension	Adjust chain tension with idler sprocket.
Worn wheel bushing	Replace bushings if bushings have excessive wear.
Worn sprockets	Replace sprockets if sprockets have excessive wear
Sheared key on gearbox sprocket	Replace key if key is sheared.
Sheared key on motor driveshaft.	Remove motor and replace key, if key is sheared.
Faulty gearbox	Check that the gearbox output shaft is not turning when motor is running. Replace gearbox.
Low battery voltage	Check if solenoids are clicking. Recharge or replace 12-volt main batteries.

8. Circuit breaker blows

Possible Cause	Check/Repair
Dirty drive chain	Clean drive chain if dirty.
Drive chain too tight	Check chain tension and make necessary adjustments. Refer to Maintenance-Check the chain tension.
Loose electrical wire	Open electrical box and check wires and connectors
Faulty circuit breaker	Check circuit breaker and replace if necessary
Motor brushes faulty	Check motor brushes and replace if necessary. Refer to Electrical Section-Checking the drive motor.
Drive chain idler sprocket does not turn	Check if idler sprocket turns. Replace if necessary
Drive motor faulty	Check motor. Check if wire to motor is overheating. Replace motor if necessary. Refer to Mechanical Service-Removing a drive motor.

Mechanical Service

I. Removing the top cover

1. Disconnect the negative battery cables from the rear battery.
2. Disconnect the switch wires from the on/off the switch.
3. Disconnect the charger receptacle wires from the batteries.
4. Remove the top portion of the antenna with a 7/16 inch wrench.
5. Remove the antenna retaining nut to remove the antenna base from the cover.
6. Disconnect receiver cable from receiver.
7. Remove the front door support chain.
8. Remove the two cap screws retaining the top cover to the rear plate.
9. Remove the four cap screws retaining the top cover to the base plate.
10. Lift the top cover straight up and off the machine.
11. To reinstall top cover reverse the above procedure.

II. Removing the wheels

1. Disconnect the negative battery cables from the rear battery.
2. Raise and support the machine with a chain hoist or blocks to suspend the wheels off the ground.
3. Remove the plastic bottom side bumper to gain access to the chain and idler sprocket.
4. Loosen drive chain idler sprockets and remove chains.
5. Remove cap screw from the end of the axle shaft and pull wheel/hub assembly off the end of the axle.
6. Remove the three nuts retaining the hub assembly to the wheel (Note when reinstalling the hub assembly to the wheel, do not tighten the three nuts until the assembly is on the axle to ensure proper alignment.)
7. Wheels should be installed in sets of four to keep the machine driving straight.
8. When installing new bushings, coat axle with grease before reinstalling the wheels.

III. Removing the drive motor

1. Disconnect the negative battery cables from the rear battery.
2. Follow the procedure for removing the top cover.
3. Remove the electrical box cover and disconnect the wire nut connectors.
4. Separate the plastic conduit at the motor by loosening the plastic conduit nut and then feeding the wires out of the motor wiring access box.
5. Remove the four cap screws holding the two drive motors together.
6. Remove the four cap screws mounting the drive motor to the gearbox..
7. Lift drive motor straight up off gearbox.
8. To reinstall drive motor reverse the above procedure.

Note: Be sure to stall inshear key when reinstalling drive motor.

IV. Removing a gearbox

1. Disconnect the negative battery cable from the rear battery.
2. Follow the procedure for removing a drive motor.
3. Remove the batteries.
4. Remove the drive chain.
5. Remove the eight ¼ inch cap screws holding the gearbox to the mounting bracket.
6. Remove the gearbox.
7. To reinstall gearbox reverse the above procedure.

V. Removing an axle

1. Disconnect the negative battery cables from the rear battery.
2. Follow the procedure for removing the wheels.
3. Loosen the set screws holding the axle to the axle housing.
4. Slide the axle out of the axle housing.
5. To reinstall axle reverse the above procedure.

VI. Replacing the gearbox seal

1. Disconnect the power.
2. Remove drive chain on side of bad seal.
3. Loosen the sprocket set screw and remove sprocket and square key from gearbox shaft.
4. Remove the 4 cap screws from the shaft end of the gearbox to remove gearbox endplate.
5. Remove the old seal from the endplate.
6. Drive the new seal into the endplate with care that the seal is not ruined.
7. Replace end plate, key and sprocket.
8. Replace drive chain and tighten.

VII. Replacing gearbox broken shaft

NOTE: The broken shaft can be replaced without removing the cover.

1. Disconnect the power.
2. Remove the rear battery.
3. Remove the drive chain
4. Remove both end plates from the gearbox.
5. Remove the seal from shaft side of the endplate.
6. Drive the new seal into the endplate, taking care that the seal is not ruined.

NOTE: If replacing shaft only, remove old bearings and gear from old shaft and fit them unto the new shaft. If replacing gearbox shaft assembly, continue.

7. Feed the shaft assembly into the gearbox from the inside gearbox cover.
8. Align bevel gear with worm gear by slightly turning the shaft.
9. Replace both end plates.
10. Replace sprocket and square key and tighten sprocket set screw.
11. Replace and tighten chain.
12. Replace rear battery and reconnect power.

V. Replacing the remote control batteries

1. Remove the remote control from the protective case.
2. Remove the two screws from the back of the remote.
3. Open the remote and replace the two AA batteries.
4. Replace the remote control cover and reinsert the two screws.
5. Tighten the two screws and put back into the protective case.

Electrical service

Refer to Electrical Block Diagram of the single speed Boar Bot on page 27.

I. Checking the power switch

1. Disconnect the wires from the circuit breaker to the main drive motors.
2. Attach the black lead of the digital voltmeter to the negative terminal of the rear battery.
3. Turn on the power switch.
4. Test for voltage on both terminals of the power switch with the red lead of the digital voltmeter. NOTE (If the Boar Bot is a two speed than the battery voltage will be 12 volts not 24 volts.)
    a. 24 volts only on one side of the switch – Faulty switch Replace switch.
    b. 24 volts on both sides of the of the switch - Switch OK.
    c. 24 volts on neither side of the switch – Dead batteries, blown 3 Amp fuse or a bad connection between switch and batteries.

II. Checking the Remote Control

1. Check if the LED light located in the corner of the remote control flashes when any or all the remote switches are pressed.
    a. Flashing LED light usually indicates that remote control is OK.
    b. No flashing LED light.—Replace remote control batteries.
    c. Batteries replaced and no flashing LED light.—Replace remote control.

NOTE: When the operation of the Boar Bot is erratic, replace the remote control's AA batteries.

III. Checking the receiver unit inside the single speed, old 2-speed, Boar Bot

1. Disconnect the drive chains or place the Boar Bot on blocks allowing the wheels to turn without the Boar Bot moving.
2. Turn on the power switch.
3. Test the power switch as outlined above.
4. Test the remote control as outlined above.
5. Check the 3 Amp receiver fuse on the cover of the electrical box.
6. Check if the light in the corner of the receiver unit is on.

   NOTE: If the receiver unit light is on, you have power to the receiver.
   If the receiver unit light is not on, proceed as follows.
7. Remove the cover of the electrical box.
8. Remove the two orange wire nuts.
9. Place the red lead of the digital voltmeter on the heavier red wire coming from the switch. Place the black lead of the digital voltmeter on the black wire coming from the terminal block.
10. If the voltmeter reads 24 volts and the receiver unit light is not on, the receiver is faulty.(Two speed Boar Bot voltage will be 12 volts instead of 24 volts.)
11. If the voltmeter does not read 24 volts, check for a bad connection.

IV. Checking the single speed, old 2-speed, Solenoids

1. Verify that the receiver unit is working properly by following the procedure outlined above.
2. Place the Boar Bot on blocks allowing the wheels to turn freely without the Boar Bot moving.
3. Remove the cover of the electrical box.
4. Turn on the power switch.
5. Press the remote control switch corresponding to direction in which the Boar Bot is not responding and listen for a click from the solenoid.
6. If the solenoid does not click, place the black lead of the digital voltmeter on the black wire connection on the bottom of the solenoid and the red lead on

signal wire in question (old style receiver: white, blue, green or brown -or- new style receiver: green, orange, tan, yellow) and press the remote control button in question. If the digital voltmeter reads 24 volts, replace the solenoid. (The voltage will read 12 volts for the two speed in LO speed.)

7. If the solenoid does click, place the red and black leads of the digital voltmeter, across the bottom terminals of the forward solenoid for the side in question (left or right). The digital voltmeter should read 24 volts when the forward direction button of the remote control for the side in question is pressed and 0 volts when the reverse direction button of the remote control for the side in question is pressed. If the two digital voltmeter readings are not 24 volts and volts, respectively, replace the solenoid. If the digital voltmeter readings are correct, continue.

8. If the solenoid does click, place the red and black leads of the digital voltmeter across the bottom solenoid terminals of the reverse solenoid for the side in question (left or right). The digital voltmeter should read 0 volts when the forward direction button of the remote control for the side in question is pressed and 24 volts when the reverse direction button of the remote control for the side in question is pressed. If the two digital voltmeter readings are not 0 and 24 volts, respectively, replace the solenoid. If the digital voltmeter reading is correct, the solenoid is good.

V. 2.0 Electrical System Trouble Shooting

Checking power to Receiver Unit:

1. Place machine on blocks so wheels aren't touching the ground, or disconnect drive chains.
2. Place black lead from voltmeter on the ground side (black wire) of the power block on electrical box cover. Use red lead from voltmeter to check voltage on each side of the 2-circuit breakers and the 3-fuse holders (should be at least 24 volts each side).
3. Turn switch on and use the red voltmeter lead to check both red wire terminals on the switch (should be 24 volts on both terminals).
4. Remove the 2 wire nuts off the red and black wires going into the Receiver harness.

Place the red voltmeter lead on the red wires and the black voltmeter leads on the black wires (should be at least 24 volts).

5. If there is 24 volts at all these locations and you verified the transmitter (remote) is working properly, and the receiver still isn't functioning, the receiver is bad.
6. If you don't have 24 volts at any of these locations, check for bad connections, broken wires, blown fuses, worn fuse holders, or bad circuit breakers.

Checking Functionality of Receiver if it has correct voltage to it, but still doesn't work correctly or at all.

1. Place machine on blocks or disconnect drive chains.
2. Place black lead from voltmeter on the ground side (black wire) of the power block on the electrical box cover. Place the red lead from the voltmeter on each of these wires coming from the receiver harness, where they connect to the power strip, while holding the correct function button on the remote (see below).
   -Red lead goes to:
   Tan wire while pressing the right reverse function button.
   Yellow wire while pressing the right forward function button.
   Green wire while pressing the left reverse function button.
   Orange wire while pressing the left forward function button.
3. Should have 24 volts at all these connections with the switch on and pressing the correct function button. If you do the receiver is working properly.
4. If you don't have 24 volts at any one of these locations with the switch on and pressing the correct function button, the receiver is bad.

Checking Electronic Speed Boards

1. Place machine on blocks or disconnect the drive chains.
2. Verify the receiver is functioning properly by following the previous steps.
3. Place black lead from the voltmeter on the ground side (black wire) of the power block on the electrical box cover. Use the red lead from the voltmeter to check voltage on the: motor positive post, battery positive post, and motor negative post located on the top side of the speed board that you are testing (should be 24 volts on all of these).
4. Verify what side speed board you are wanting to test (right side/left side of machine), and use the same side function buttons on the remote when testing the following voltages for that speed board.
5. With your black lead from the voltmeter still on the ground side of your power block, place the red lead of your voltmeter on the motor positive post while pushing the forward function button for the correct side you are testing (should be at least 24 volts).
6. While still holding the forward function button on the remote, place your red voltmeter lead on the motor negative post (should read 0 volts).
7. Place red voltmeter lead on the motor negative post on the top side of the speed board you are testing. Press the reverse function button for the correct side you are testing (should read at least 24 volts).

8. While still holding the reverse function button on the remote, place the red lead from your voltmeter on the motor positive post (should read 0 volts).
9. If any of these readings are wrong (0 volts or 24 volts where it shouldn't be) the speed board is faulty.

Checking Potentiometer and Hi/Lo Switch

1. Place machine on blocks or disconnect the drive chains, so machine can't move when pushing function buttons.
2. Place black lead of the voltmeter on the ground side (black wire) of the power block on the cover of the electrical box.
3. While pressing the right function button (forward or reverse) with machine in high and power switch turned on, place the red lead from the voltmeter on each of these connections on the power strip to check voltage.
   -right side machine red wire coming from potentiometer.
   -right side machine blue wire coming from potentiometer.
   -yellow wire going to the Hi/Lo switch.
   -black wire going to the Hi/Lo switch.
   (All these connections should have the same voltage in high: 7.5-8.5 volts)
4. Switch machine to low speed.
5. Press right function button (forward or reverse). Test same connections again.
   -Right side machine red wire from potentiometer and yellow wire from Hi/Lo switch should have same reading (7.5-8.5 volts) constant.
   -Right side machine blue wire from potentiometer and black wire going to Hi/Lo switch should have varying voltages depending on the location of the potentiometer knob. Adjust potentiometer and make sure this voltage increases and decreases (0-8 volts).
6. Check left side in the same way. Place machine in high.
7. While pressing the left function button (forward or reverse), place the red lead from the voltmeter on each of these connections on the power strip and check voltages.
   -Left side machine red wire coming from potentiometer.
   -Left side machine blue wire coming from potentiometer.
   -Red wire going to Hi/Lo switch.
   -Blue wire going to Hi/Lo switch.
   (All these connections should have same voltage in high (7.5-8.5 volts)
8. Switch machine to low speed.
9. Press left function button (forward or reverse) and test voltages on same connections again.

   -Left side machine red wire coming from potentiometer and red wire going to Hi/Lo switch should have same voltage (7.5-8.5 volts) constant.

   -Left side machine blue wire coming from potentiometer and blue wire going to Hi/Lo switch should have varying voltages depending on the location of the

potentiometer knob. Adjust potentiometer and make sure this voltage increases and decreases (0-8 volts).

10. Green wires coming from potentiometer need good connections on the power strip for the potentiometer to work.
11. Note: there is no voltage at any of the potentiometer wires or the Hi/Lo switch wires until a function button is pressed.
12. If machine operates in High but not in Low, potentiometer could be defective.
13. If you can adjust the speed of the machine with the potentiometer in High and Low speed, than Hi/Lo switch is probably defective. Should not be able to adjust machine speed with the potentiometer when it is in high, just when it is in low.

VI. Checking a drive motor

1. Test all other electrical components as outline In **Electrical Service.**
2. Disconnect the negative battery terminals from the rear battery.
3. Check the motor brushes by removing the small cover on the side of the motor and inspect for worn, broken or stuck brushes.
4. Replace the brushes if necessary, otherwise continue with checking drive motor procedure.
5. Remove the drive as outlined in the **Mechanical Service** section.
6. Have the motor tested at an authorized motor repair service center.

VII. Checking the battery charger

1. Attach the digital voltmeter to the negative terminal of the rear battery and to the positive terminal of the front battery, record the reading.
2. Attach the battery charger to the Boar Bot by way of the charger plug and allow the charger to charge the batteries for a couple of hours.
3. Reattach the digital voltmeter and record the reading.
4. If the digital voltmeter reading increased, the charger is good. Otherwise, the charger is not working. Replace the battery charger.

VII. Checking for low voltage symptoms for the single speed Boar Bot

Low voltage symptoms include but are not limited to

a. Boar Bot does not move when the remote control buttons are pressed.

b. Erratic movement of the Boar Bot.

c. Solenoids are clicking but the Boar Bot does not respond.

The Boar Bot obtains power from a 24 volt electrical system. Two 12 volt deep cycle batteries connected in series furnish the power to operate the Boar Bot. For the Boar Bot to work properly, the battery voltage needs to be 24 volts, minimum and each individual battery voltage needs to be 12 volts, minimum. If the battery voltage is below 24 volts, the Boar Bot will exhibit the low voltage symptoms described.

Keep the battery voltage above 24 volts by charging the batteries whenever the Boar Bot is not in use.

1. Testing the individual batteries

   Using a digital voltmeter, check each individual battery for a minimum of 12 volts. To test the batteries, place the black lead of the digital voltmeter on the (-) negative terminal of the battery and the red lead of the digital voltmeter on the (+) positive terminal of the battery. If the voltage is less than 12 volts on either battery, the battery will need to be charged or replaced. If each battery has a minimum of 12 volts, than check the system for a combined voltage of 24 volts.

2. Testing the combined battery voltage

To test for 24 volts, the digital voltmeter must be placed across both batteries. Place the black lead of the digital voltmeter on the (-) negative terminal of the rear battery. (The rear battery is located on the side the boar is attached to.) Place the red lead of digital voltmeter on the (+) positive terminal of the front battery. (The front battery is located behind the large door and below the gray electrical box.) The digital voltmeter reading should be at least 24 volts. If the reading is less than 24 volts, than the white wire connecting the rear battery positive post to the front battery negative post has a bad connection. Check for loose or bad terminal connections.

3. Testing internal voltage

If the digital voltmeter reading of the two combined batteries is at least 24 volts and the 3 amp fuse is good, remove the cover of the electrical box and check the voltage at the center fuse for a minimum of 24 volts. To test, place the red lead of the digital voltmeter on the bottom side of the fuse holder and place the black lead of the digital voltmeter on the black wire connection on the bottom of a solenoid. If the voltage reading is not 24 volts, check the battery connections on the positive terminal of the front battery and the negative terminal of the rear battery.

4. Testing receiver unit for voltage

If the digital voltmeter reading is 24 volts and the Boar Bot does not operate, remove the two orange wire nuts connecting the receiver to 24 volts. Place the red lead of the digital voltmeter on the heavier red wire coming from the power switch which was connected inside the wire nut. Place the black lead of the digital voltmeter on the black wire coming from the terminal block which was connected inside the other wire nut. If the reading is 24 volts, reconnect the two orange wire nuts. If the power light on the receiver unit is not on, the receiver may be bad and may need to be replaced.

IX. Checking the old two speed Boar Bot

Refer to the Electrical Block Diagram of the two speed Boar Bot on page 28 & 29.

Mode of operation

The two speed Boar Bot operates mechanically the same as the single speed Boar Bot but it also has the added feature of being able to change the speed it travels. In the single speed Boar Bot the receiver, solenoids, and motors always operate with 24 volts; whereas in the two speed Boar Bot the receiver and solenoids operate with 12 volts and the motors operate at 12 or 24 volts depending on the mode of operation— Lo speed or Hi speed.

The two switching solenoids have the function of providing 12 volts or 24 volts to the two electric motors depending on the mode of operation and when traveling in a forward direction. When the two speed Boar Bot travels in reverse, the speed will automatically default to Lo speed regardless of the position of the Hi/Lo switch.

Checking voltages on an old two speed Boar Bot

With the two speed Boar Bot in Lo speed operation both batteries are forced to have the same voltage because of the way the two switching solenoids connect the two batteries. If the two battery voltages are not the same, then there is a bad connection between the two batteries. To measure the voltage of each individual battery, one of the battery terminals has to be disconnected. Once the batteries terminals are disconnected, measure the voltage across each battery by placing the digital voltmeter across the battery terminals of each individual battery. Any battery voltage under 12 volts will result in erratic or no operation of the Boar Bot.

In Hi speed operation the battery voltage across both of the batteries (positive terminal of the rear battery to the negative terminal of the front battery) should be 24 volts.

Trouble shooting an old two speed Boar Bot

1. The switching solenoids should always click by switching the Hi/Lo switch when the Boar Bot switch is on regardless if the receiver will operate. If the switching solenoids do not click then there is no power at the terminal block in the electrical box. Check the circuit breakers (or fuses), the batteries or the wire /wire terminals.

The switching solenoids operate from the main (front) battery. If the main battery is bad or has a bad connection, switching to Hi speed will cause the switching solenoids to clatter because the floating (rear) battery is being switched between being in series and being in parallel with the main battery. (Powering and not powering the solenoids.) The receiver will also not work.

2. Unlike the single speed Boar Bot where a blown circuit breaker only effects one side of the Boar Bot, a blown circuit breaker on the two speed effects the entire Boar Bot.

A. A blown circuit breaker on the floating (rear) battery will cause the Hi speed to stop working but the Lo speed will still work but with reduced power and less operating time between charging the battery.

B. A blown circuit breaker on the main (front) battery will cause the switching solenoids to clatter as discussed above.

C. Both circuit breakers blown will result in a dead Boar Bot.

3. If the two speed Boar Bot does not work in Lo or Hi speed and the receiver LED light is off, check the following:

A. Check the two main circuit breakers.

B. Check the 3 amp fuse.

C. Check the batteries for low voltage.

D. Check the on/off switch and associated wiring.

E. Check if there is power to the receiver. Refer to **Checking the receiver unit inside the Boar Bot** (page 16). If the receiver has power, then the receiver could be bad.

4. If the two speed Boar Bot does work in Lo speed but not in Hi speed, then the receiver and solenoids are working.

A. Check if the switching solenoids are clicking.

B. Check the Hi/Lo switch.

C. Check the rear battery, associate wiring and terminals.

5. Default relay failure will cause the following symptoms.

A. The Boar Bot will not operate in Hi speed.

B. The Boar Bot will not default to Lo speed in reverse operation.

6. Default isolation diodes failure will cause the following symptoms.

A. The Boar Bot will not default to Lo speed in reverse operation.

B. Right or left reverse will result in all wheels in reverse.

7. Switching solenoid failure of either solenoid or both solenoids will result in no Hi speed operation.

8. Circuit breaker failure of either circuit breaker has occurred if the Boar Bot while operating properly begins a gradual slow down and finally comes to a stop. If the Boar Bot is switched off and then switched on again, the movement of the Boar Bot will repeat the gradual slow down. Replace the bad circuit breaker or breakers.

Electrical Block Diagram Single Speed Boar Bot

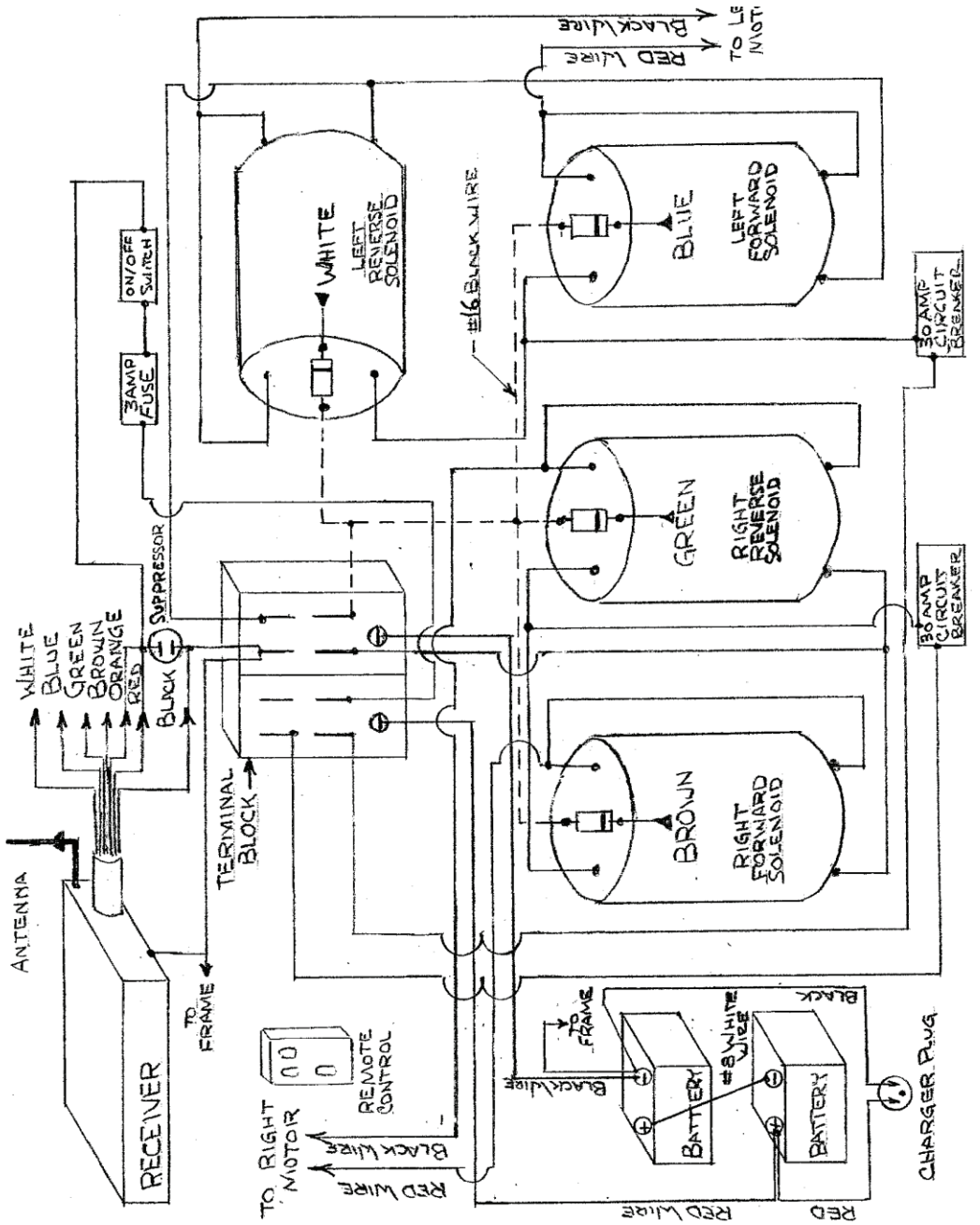


Figure 2

Electrical Block Diagram of Single Speed Boar Bot

Boar Bot Serial # 095501and Below

Old Receiver 990397-20

ELECTRICAL BLOCK DIAGRAM SINGLE SPEED BOAR BOT

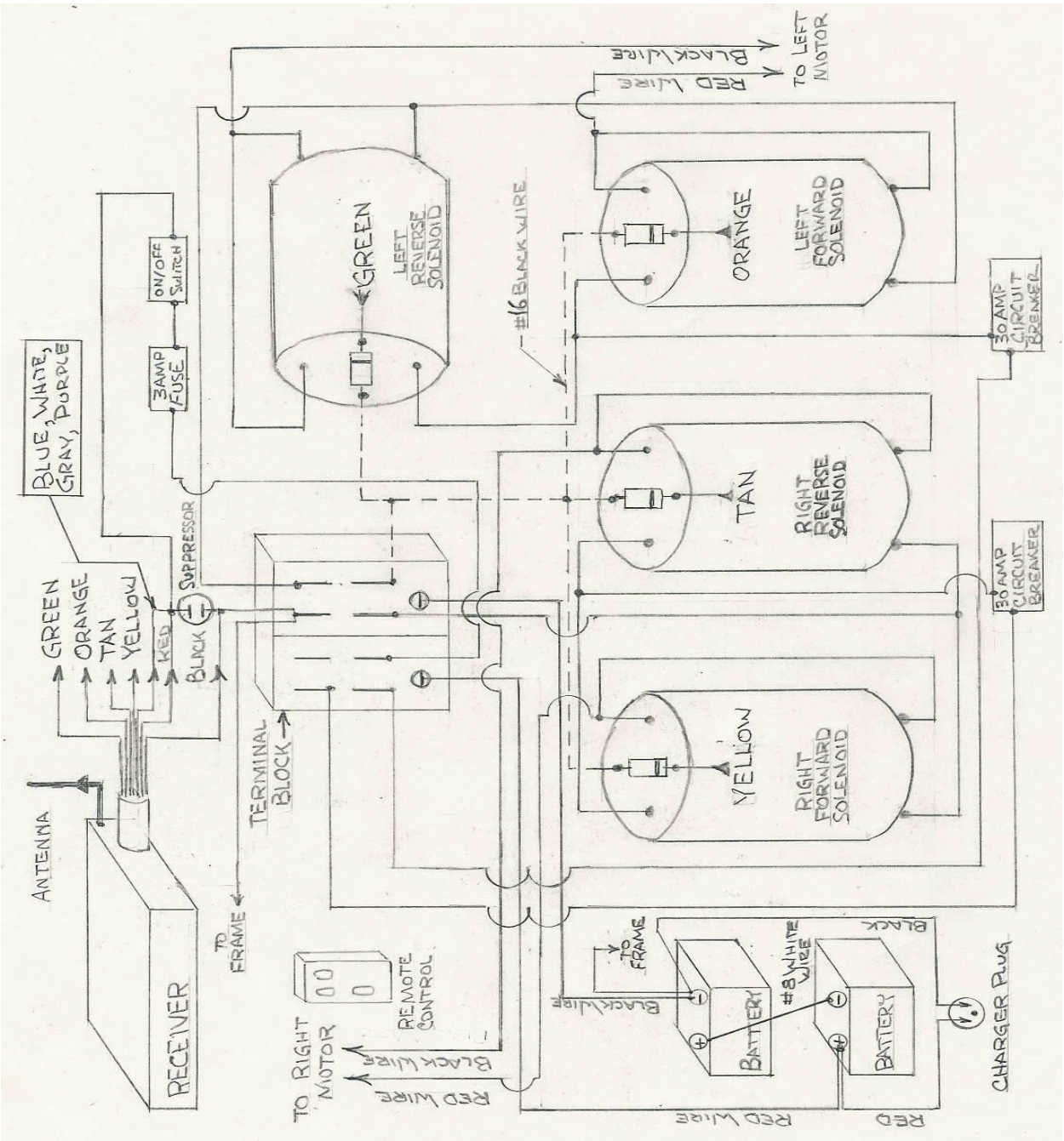


FIGURE 3

ELECTRICAL BLOCK DIAGRAM OF SINGLE SPEED BOAR BOT

BOAR BOT SERIAL # 095601 AND ABOVE

NEW RECEIVER 983107-20

ELECTRICAL BLOCK DIAGRAM TWO SPEED BOAR BOT

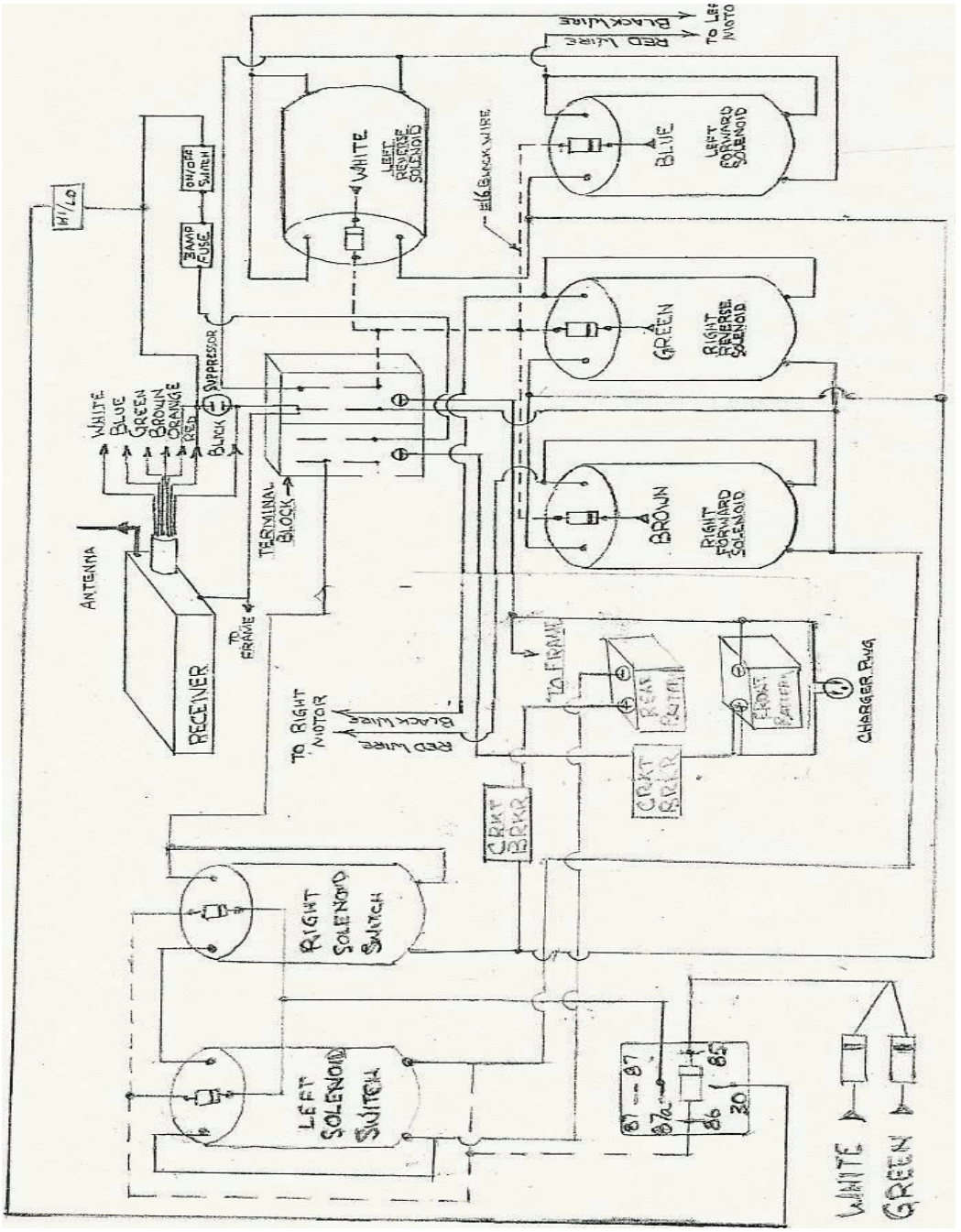


FIGURE 4

ELECTRICAL BLOCK DIAGRAM OF TWO SPEED BOAR BOT

BOAR BOT SERIAL # 095502 AND BELOW

OLD RECEIVER 990397-20

ELECTRICAL BLOCK DIAGRAM TWO SPEED BOAR BOT

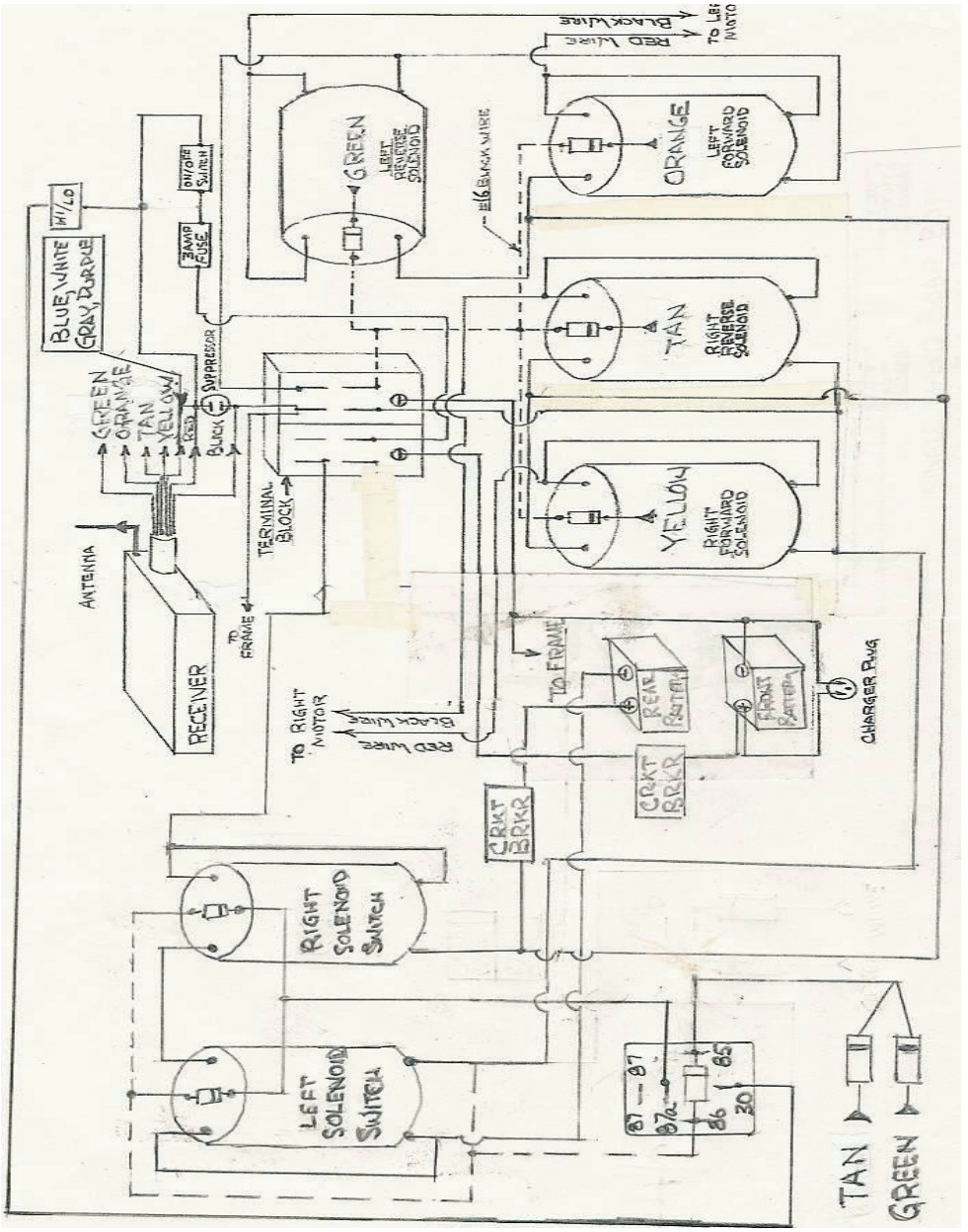


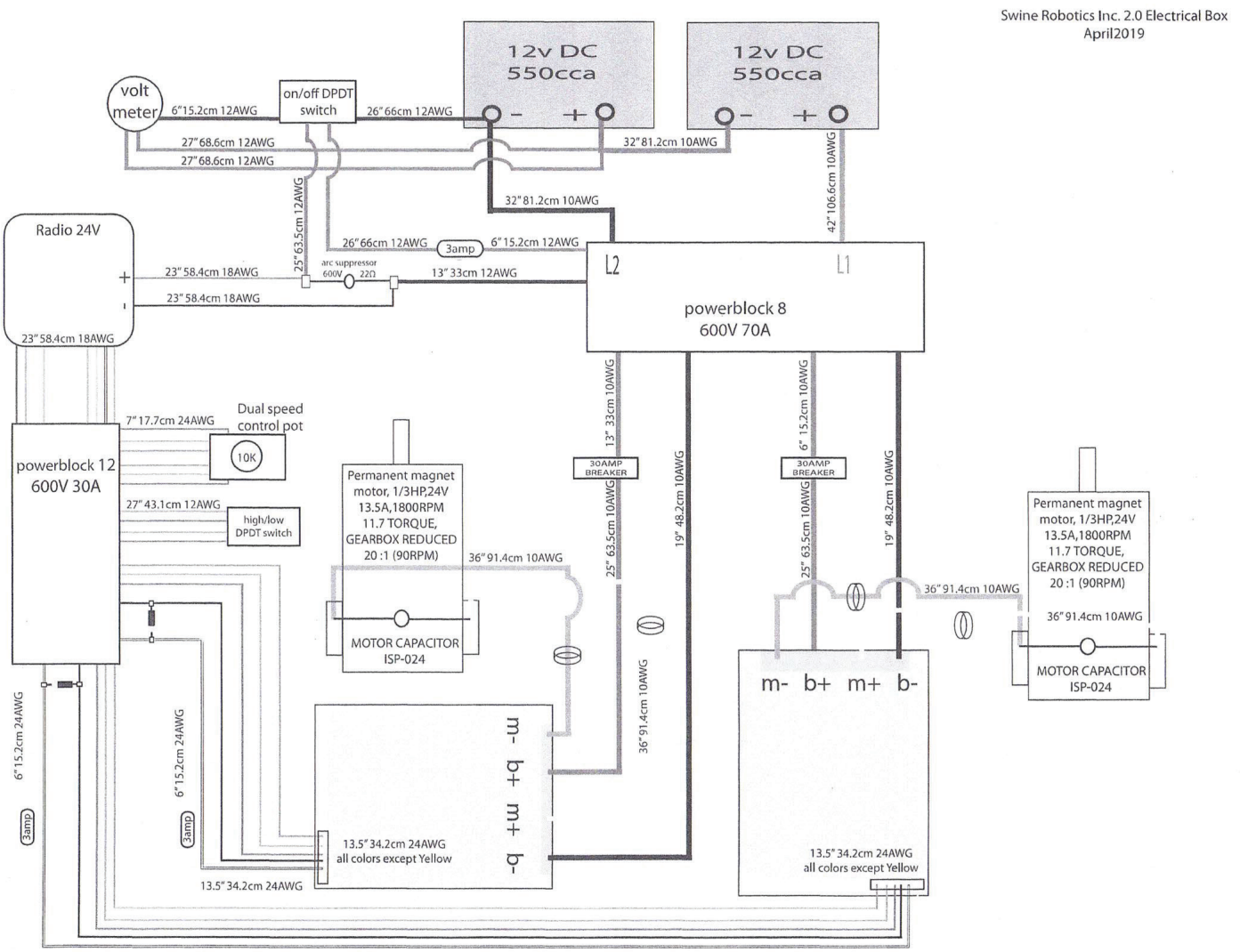
FIGURE 5

ELECTRICAL BLOCK DIAGRAM TWO SPEED BOAR BOT

BOAR BOT SERIAL # 095602 AND ABOVE

NEW RECEIVER 983107-20

2.0 ELECTRICAL DIAGRAM



Parts Diagram Main Assembly

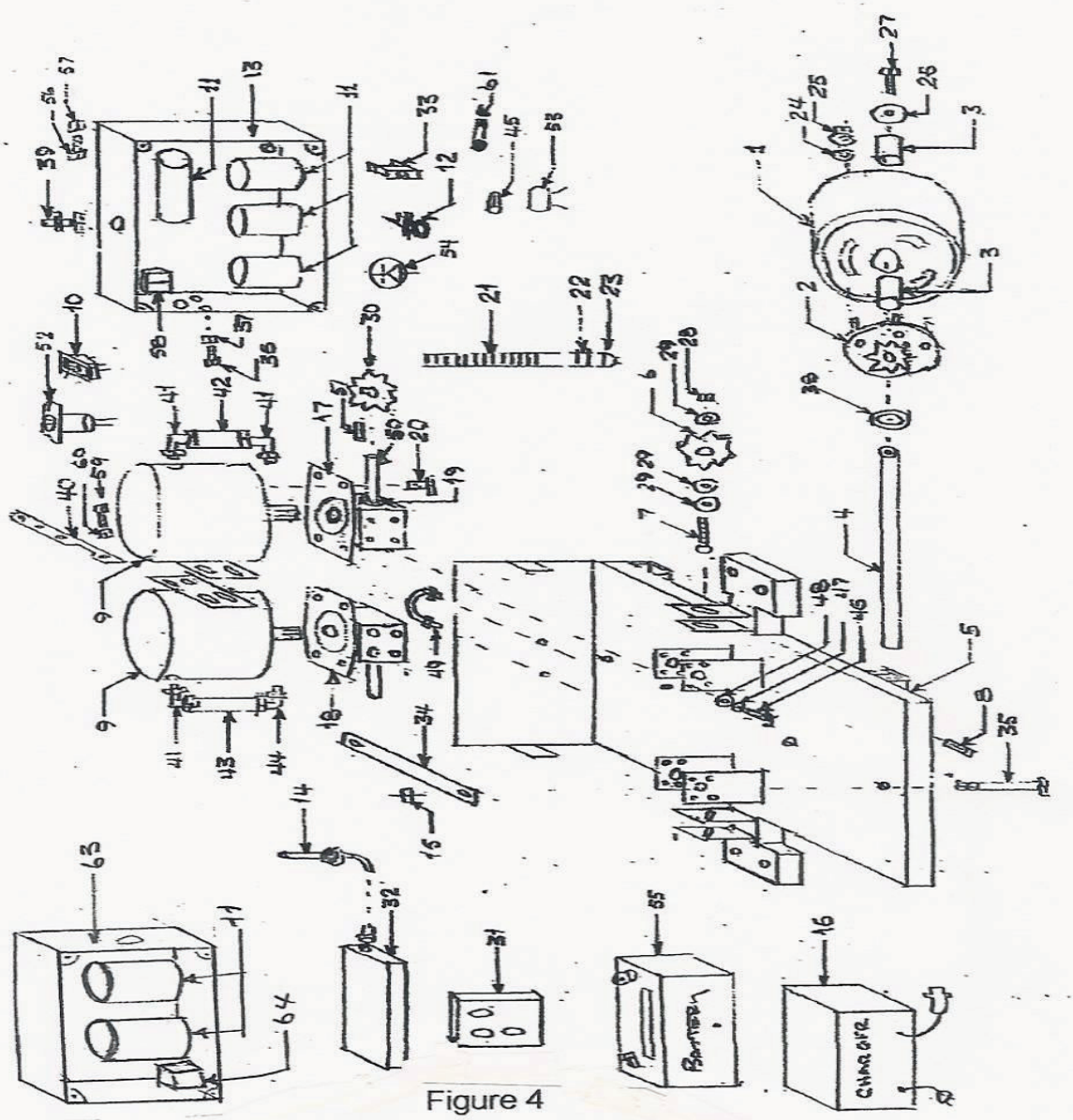


Figure 4

Boar Bot Mechanical Parts Diagram

Parts Diagram Cover Assembly

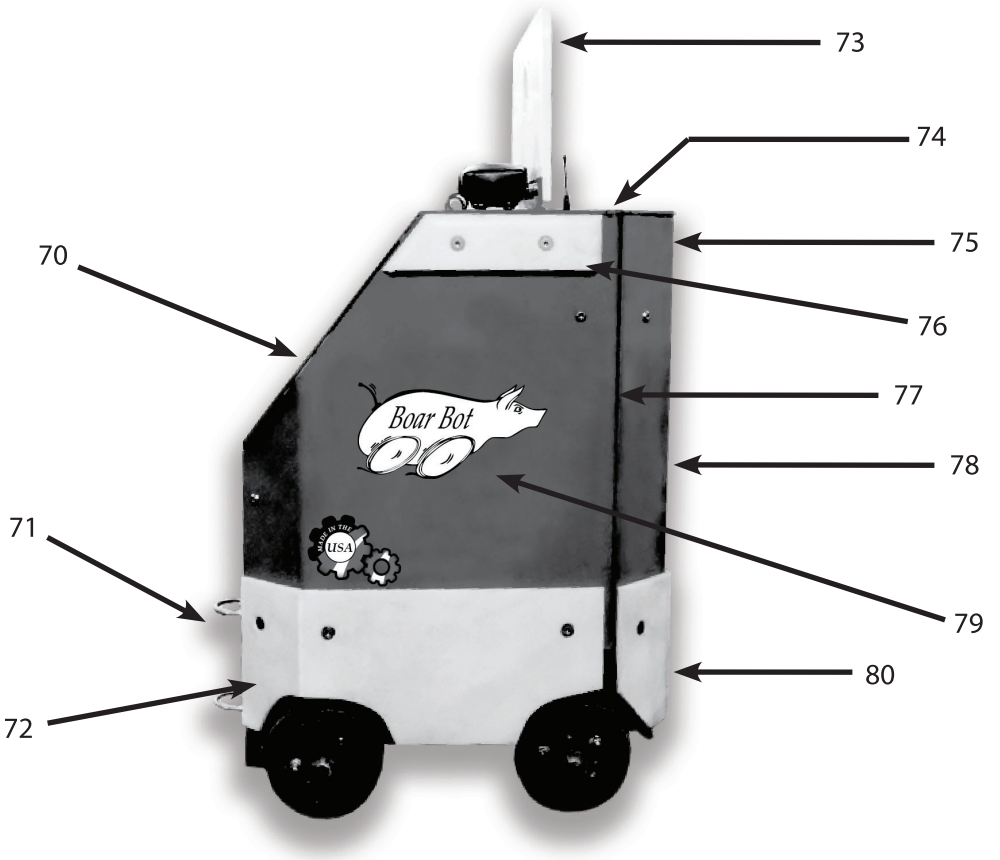


Figure 5

Boar Bot Cover Assembly

Boar Bot Parts List

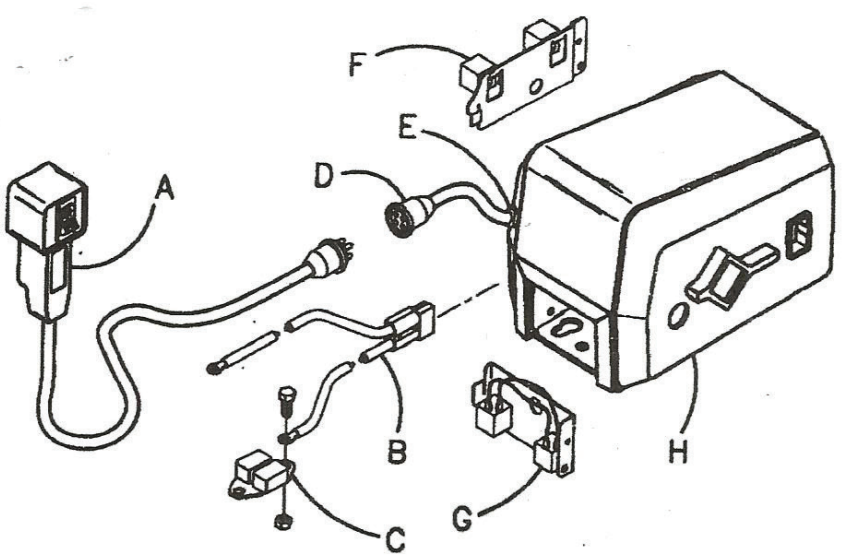
Item #	Description	Part #
2.	Wheel (4 required)	BB001
3.	Wheel plate sprocket assembly	BB002
4.	Axle bushing (2 per wheel)	BB003
4a.	Axle shaft	BB004
5.	Axle Shaft Narrow	BB004a
	Main frame	BB005

Item #		Part #
5b.	Main frame-narrow version	BB005B
6.	Idler sprocket (2 per machine)	BB006
7.	Idler sprocket bolt	BB007
8.	Axle set screw	BB008
9.	Drive motor-single speed	BB009
9a.	Drive motor-two speed	BB009A
10.	Toggle ON/OFF power switch	BB010A
10a.	Toggle Hi/Lo switch-two speed (not shown)	BB010A
11.	Solenoid (4 per machine) single speed	BB011
11a.	Solenoid (6 per machine) two speed	BB011A
12.	Fuse holder (3 amp)	BB012
13.	Electrical box	BB013
14.	Antenna	BB014
15.	Battery bolt lock nut	BB028
16.	Battery charger (24 volt) single speed	BB016
16a.	Battery charger (12 volt) two speed	BB016B
17.	Left gear box	BB017
18.	Right gear box	BB018
19.	Gear box seal	BB019
20.	Gear box cap screw	BB027
21.	Drive chain (No. 50) single speed	BB021
21a.	Drive chain (No. 50) 2.0	BB021A
22.	Connector link (No. 50)	BB022
23.	Offset link (N0. 50)	BB023
24.	Flat washer	BB111A
25.	Wheel lock nut	BB028
26.	Wheel washer	BB111
27.	Wheel cap screw	BB027
28.	Nut (Idler sprocket)	BB028
29.	Idler sprocket flat washers	BB111A
30.	Drive gear (2 per machine) single speed	BB030B
30a.	2.0 Drive gear (2 per machine)	BB030A
31.	Remote control (specify receiver ID number)	BB031
32.	Receiver unit (specify machine ID number) single speed	BB032
33.	Circuit breaker (2 required) single speed 30amp	BB033
33a.	Circuit breaker (2 required) two speed 50amp	BB033A
34.	Battery hold down bracket	BB034
35.	Battery hold down bolt	BB035
36.	Electrical box securing bolt	BB027
37.	Electrical box securing nut	BB028
38.	Axle shims	BB038
39.	Receiver electrical wire feed-thru	BB039
40.	Electrical box bracket	BB117
41.	Motor wire flexible elbow	BB104
42.	Left motor wire flexible conduit	BB041

Item #		Part #
43.	Right motor wire flexible conduit	BB041
44.	Right motor wire electrical box connector	BB104
45.	Wire nut (2 required)	BB115
46.	Gear box cap screw	BB027
47.	Gear box lock washer	BB111A
48.	Gear box flat washer	BB111A
49.	U bolt (2 required)	BB049
50.	Gear box shaft	BB050
51.	Gear box key	BB051
52.	Charger/hearse receptacle	BB052
53.	Arc suppressor (3 required)	BB053
54.	Diode (4 required) single speed	BB054
54a.	Diode (7 required) two speed	BB054A
55.	Battery (12 volt deep cycle-2 per machine) specify if narrow Boar Bot	BB055
55a.	Narrow Boar Bot Battery	BB055A
56.	Solenoid hold down bolt (6 required) single speed	BB027
56a.	Solenoid hold down bolt (9 required) two speed	BB027
57.	Solenoid hold down nut	BB028
58.	Terminal block	BB058
59.	Motor bracket bolt	BB027
60.	Motor bracket nut	BB028
61.	Fuse-3 amp	BB061
62.	Wiring harness (not shown) single speed	BB109
62a.	Wiring harness (not shown) 2.0	BB201
63.	Electrical box 2.0	BB063
64.	Reverse default relay-two speed	BB108
70.	Rear door	BB070
71.	Rear nose guard	BB071
72.	Bottom side bumper (right)	BB072
72a.	Bottom side bumper (left) (not shown)	BB072A
73.	Top vision guard	BB073
74.	Outer cover	BB074
75.	Front top bumper (not shown)	BB075
76.	Top side bumper (right)	BB076
76a.	Top side bumper (left) (not shown)	BB076A
77.	Front door support chain (not shown)	BB077
78.	Front door	BB078
79.	Boar Bot Decal	BB079
80.	Front bottom bumper	BB080

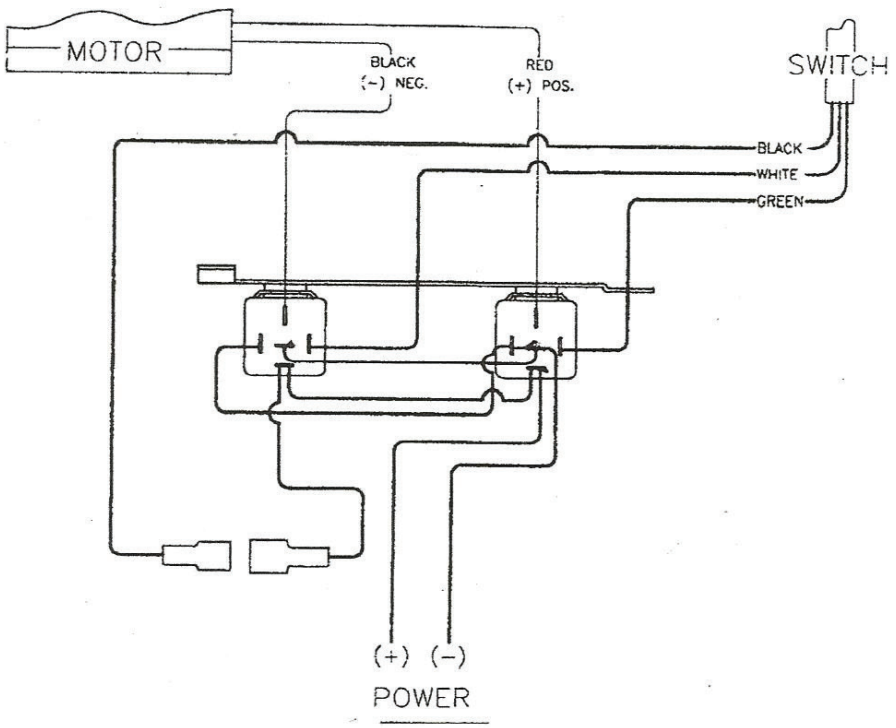
Item #		Part #
082	Charger Plug	BB082
083	D Ring For Harness	BB083
084	Harness	BB084
084A	Strap For Harness	BB084A
085	Rope	BB085
086	Gear Box Bearing	BB086
087	Gear Box Cap	BB087
088	Motor Brush Spring	BB088
089	Motor Brush Clip	BB089
090	Axle Tube	BB090
092	Large Fuse Holder	BB092
093	Brass Gear	BB093
094	Hinges	BB094
095	Hour Meter	BB095
096	Leather Case	BB096
097	Seal Plate	BB097
099	Brush Kit	BB099
100	Electrical Box Complete	BB100
101	Electrical Cover Lid	BB101
102	Electrical Wire Per. Ft.	BB102
104	Conduit Connector	BB104
106	Receiver Cord	BB106
107	Snaps	BB107
108	12 Volt Relay	BB108
109	Wiring Harness, Single Speed	BB109
110	Wire Ends	BB110
111	Washers For Wheels	BB111
112	Transmitter Strap	BB112
113	Transmitter Battery	BB113
114	Volt Meter	BB114
115	Wire Nut	BB115
116	Battery Charger Cord (Old Charger)	BB116
117	Electrical Box Bracket	BB117
118	Frame Bracket	BB118
119	Brush Cover	BB119
120	Back Plate	BB120
121	Potentiometer 2.0	BB121
122	Drive Sprocket Set Screw	BB122
200	2.0 Electrical Box Complete	BB200
201	2.0 Wiring Harness	BB201
202	2.0 Variable Speed Board	BB202
203	Wire Harness and Plug for Speed Board	BB203

APPENDIX
BUZZARD/HEARSE WINCH PARTS DIAGRAM



Ref.	Part	Number
A	Switch Assy	304325
B	Wiring Harness (complete)	304744
C	Circuit Breaker Assy	304025
D	Pigtail, 9"	304917
E	Strain Relief Bushing	205037
F	Relay Assy *(SA5015/SA7015)*	304908
G	Relay Assy *(SA9015/SA12015)*	304909
H	Cover *(SA5015/SA7015)*	404983
H	Cover *(SA9015/SA12015)*	404981
J	Motor Assy	304914

WIRING DIAGRAM



Hearse winch parts diagram
Version II

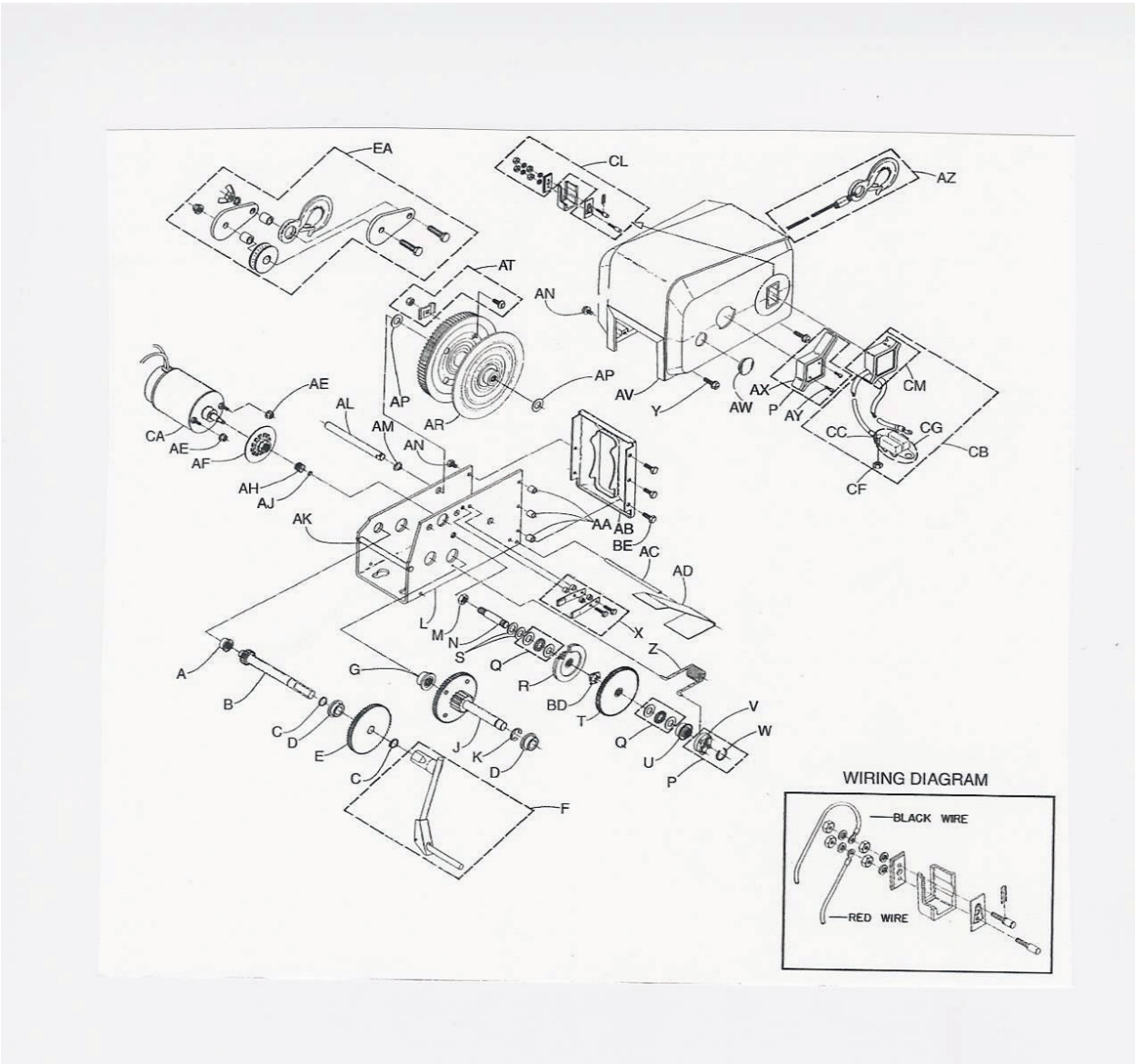


Figure 7
Hearse winch parts diagram Version II

Parts list Version II
Figure 6

Part no.	Description
A.	Switch assembly
B.	Wiring harness (complete)
C.	Circuit breaker assembly
D.	Pigtail. 9”
E.	Strain relief bushing
F.	Relay assembly (SA5015/SA7015)
G.	Relay assembly SA9015/SA12015)
H.	Cover
J.	Motor assembly

Parts list Version II
Figure 7

Part no.	Description
A.	Bearing housing assembly
B.	Primary drive shaft assembly
C.	Retaining ring (2)
D.	Bushing (2)
E.	56T gear
F.	Aux. handle assembly
G.	Drive shaft bushing housing assembly
J.	Interim. drive shaft assembly
K.	“E” ring
L.	Base
M.	Nut, 7/16 locknut
N.	Clutch stud
P.	Clutch handle replacement kit(includes V, W, AX, & AY.)
Q.	Thrust bearing replacement kit (includes item W, O-ring)
R.	Clutch gear assembly
S.	Washer (2)
T.	84T Gear assembly
U.	Clutch handle nut
V.	Clutch spring keeper
W.	“O”-ring
X.	Brake spring replacement kit
Y.	Screw, ¼-20x1 (5)
Z.	Clutch spring
AA.	Spacer (3)
AB.	Front plate
AC.	Level wind ping
AD.	Level wind

AE.	Nut, 10-32 locknut (2)
AF.	Brake disc assembly
AH.	12T Pinion gear
AJ.	“E” ring
AK.	Base spacer
AL.	Reel shaft
AM.	Retaining ring
AN.	Screw, 1/4x20x1/2 (4)
AP.	Washer (2)
AR.	Reel assembly
AT.	Rope clamp kit
AV.	Cover
AW.	Cover plug
AX.	Clutch handle
AY.	Screw - #4x1/2
AZ.	Cable & hook
BD.	Finger spring washer
BE	Top decal (not shown)
BG.	DL decal (not shown)
BH.	Clutch decal (not shown)

MOTOR PARTS

CA.	Motor assembly
CB.	Switch assembly (includes CC, CE, CF & CG)
CC.	Screw- 1/4x20x3/8
CE.	Washer – ¼ starlock
CF.	Nut – ¼-20
CG.	Circuit breaker assembly
CL.	Pocket plate replacement kit
CM.	Replacement switch kit

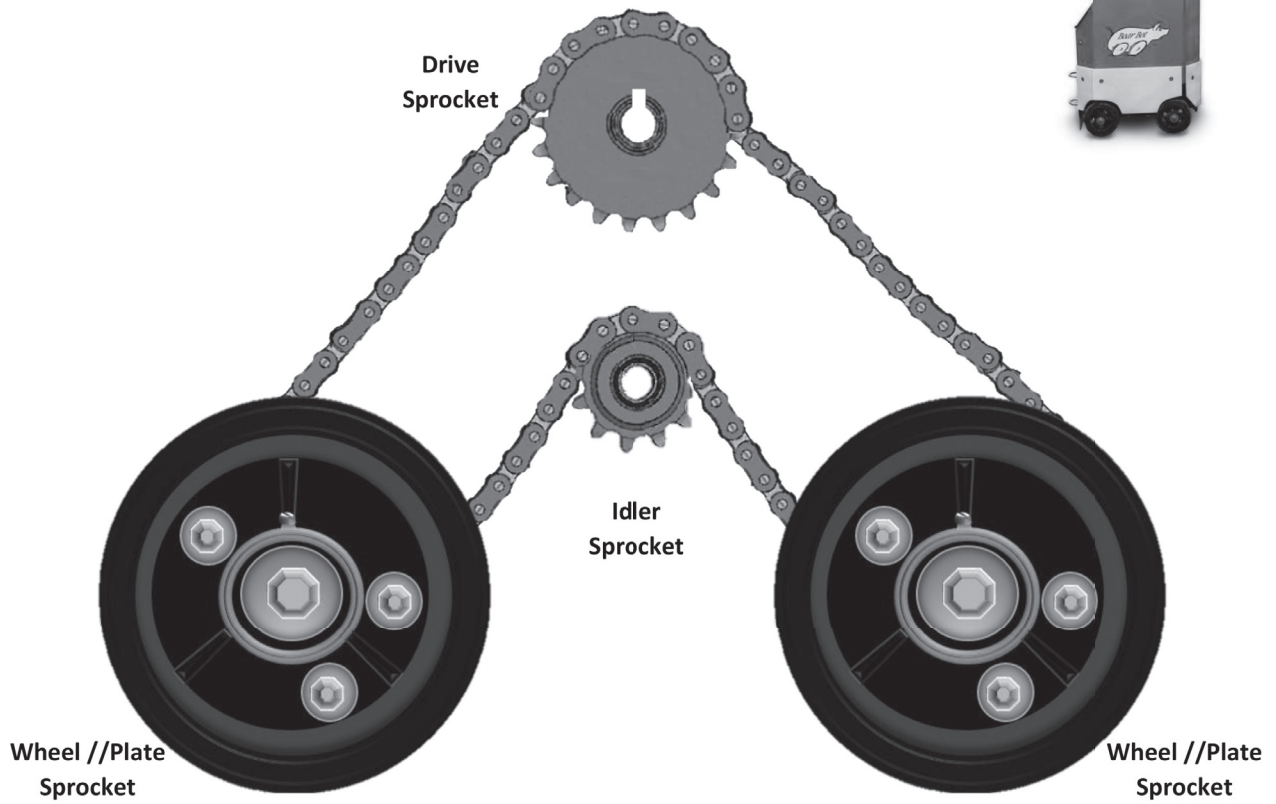
PULLEY BLOCK

EA.	Pulley block & hook (complete)

How to Auto Link the Remote to the Receiver

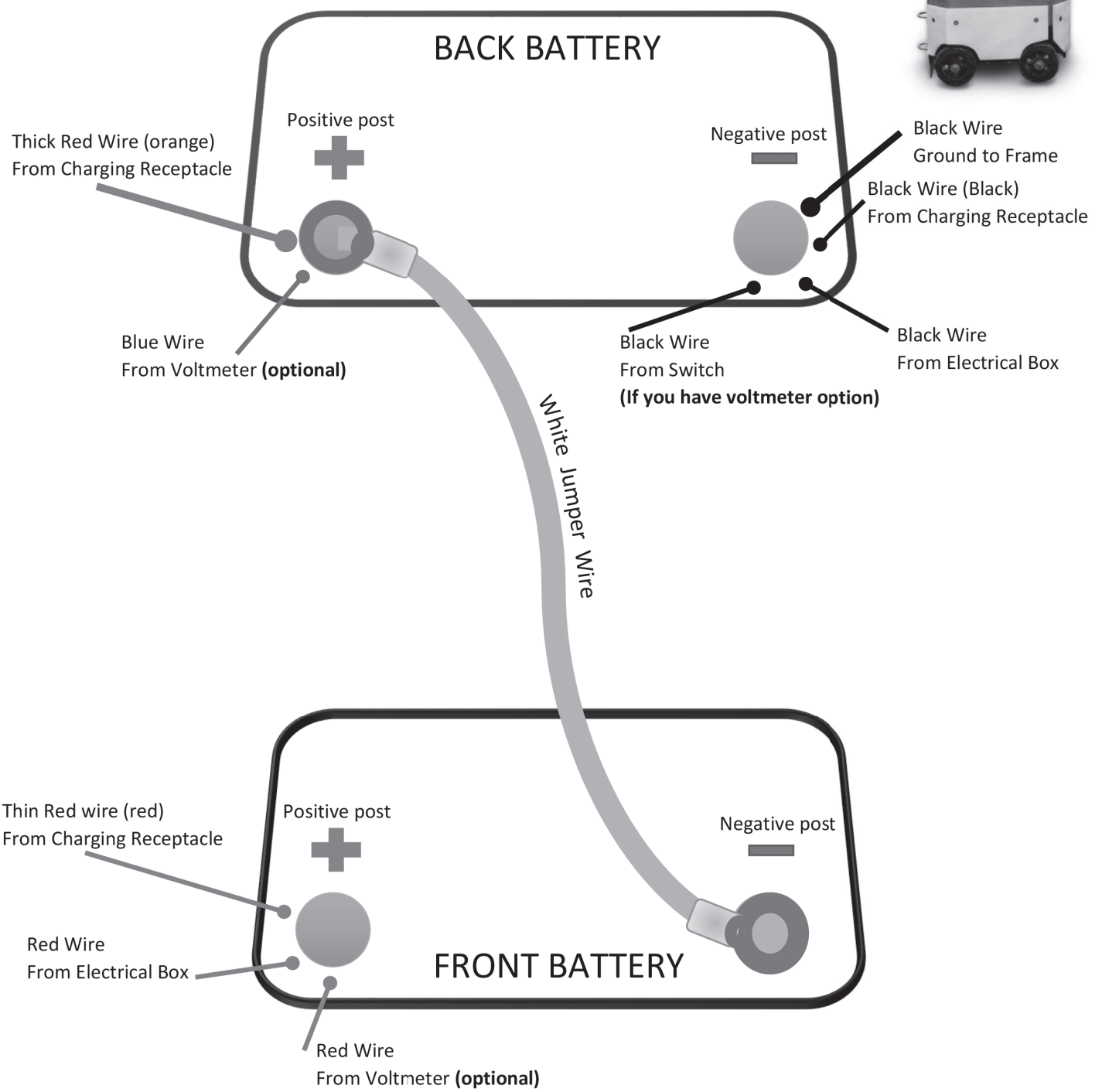
- Make sure your switch is on and your power light is lit up on the receiver.
- Press the Auto link button on the remote at the same time you are pressing the auto link button on the receiver until the signal light on the receiver stops flashing. It usually links up pretty fast, but sometimes it takes a few minutes even.
- Call with any questions or problems. 1-605-439-3510

Drive Chain Set Up



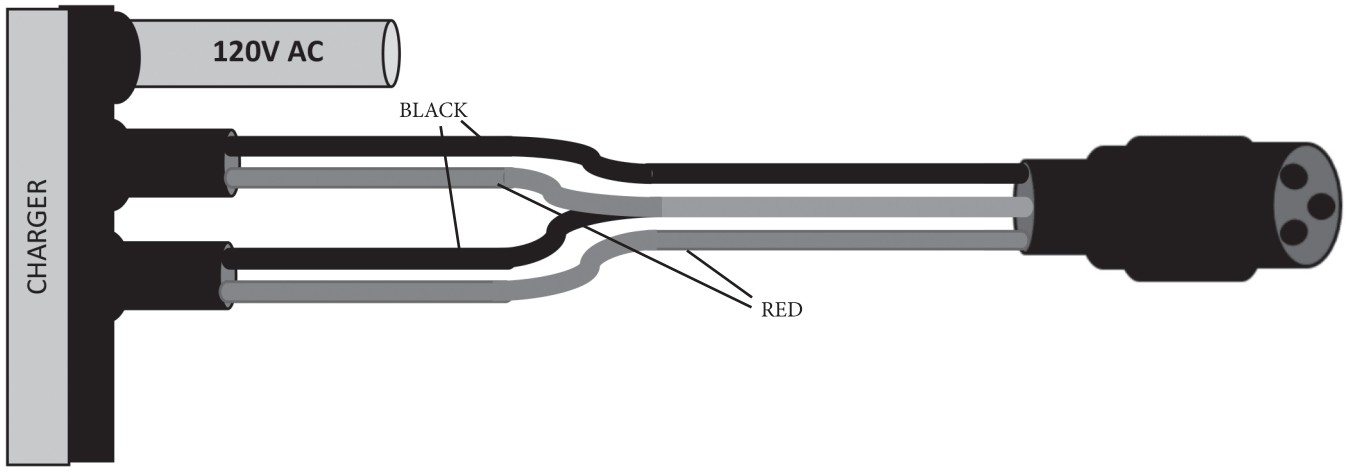
Battery Wire Hook-up Diagram

Small Door / Back of Machine

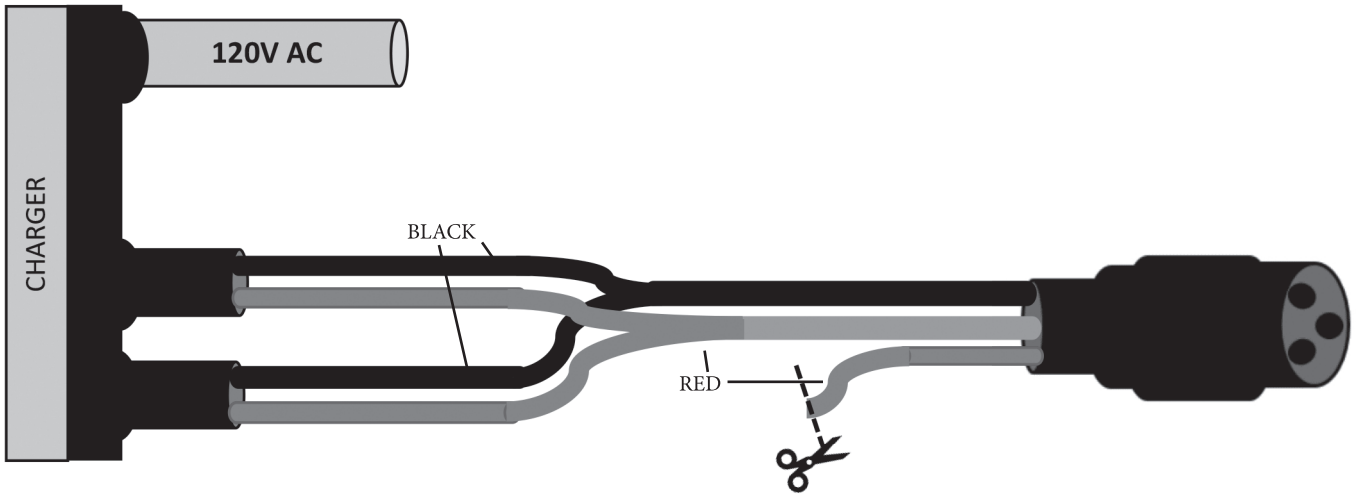


Big Door / Front of Machine

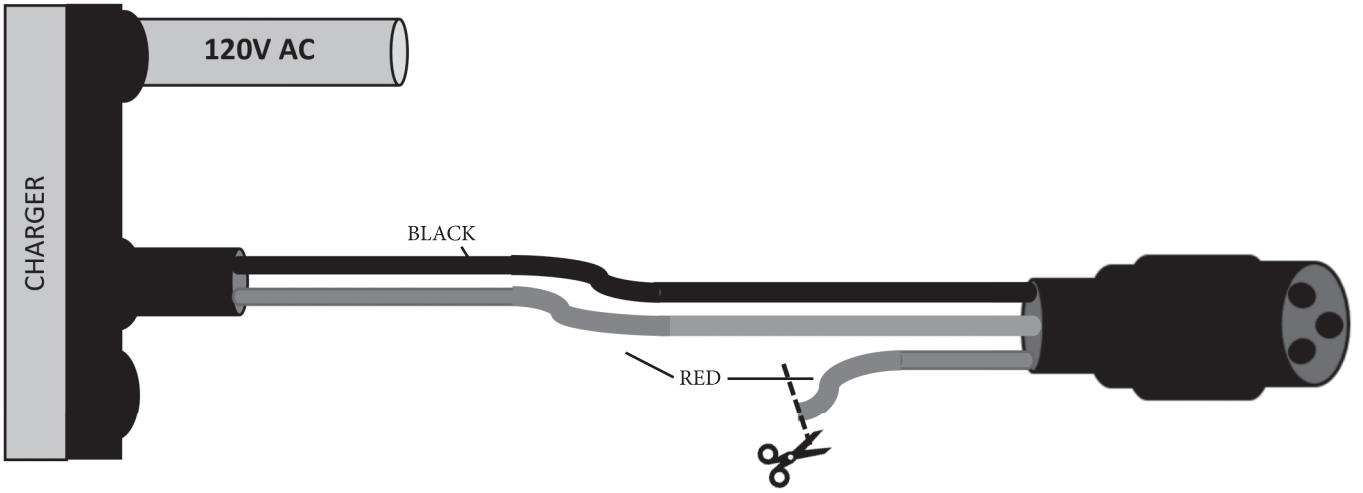
10 AMP Charger to plug **24 Volts system**



10 AMP Charger to plug **12 Volts system**



6 AMP Charger to plug **12 Volts system**



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