



Electronics Manual

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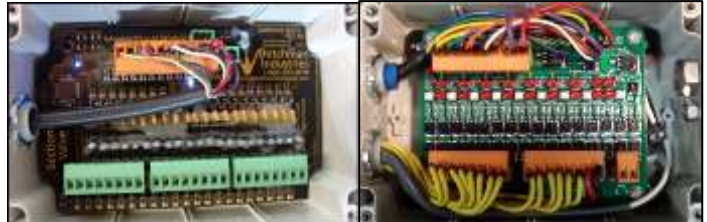
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1 Wireless Control Retrofit Diagram



Your Dutchman wireless kit comes complete with a wireless joystick controller and a wireless receiving chip. It is important to follow the step by step directions below so as to place the chip in the right location.

Step 1: Locate your troubleshooting circuit board housing which should be directly above or directly beside the main control valve of the tree spade. Open up lid or cover to see wires coming in and out as shown here.



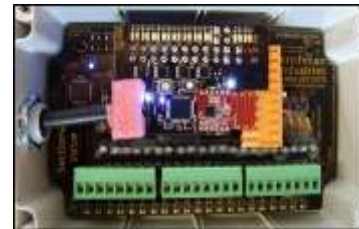
Step 2: Unclip upper wire harness which houses all coloured wires coming in from the controller side of the tree spade.



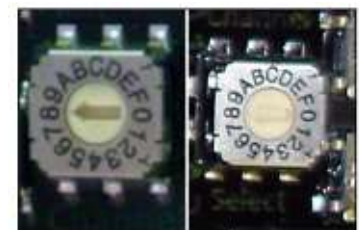
Step 3: Clip wireless receiver chip into the same location that housed the upper wire harness. Clip in as shown here. Then clip upper wire harness to side of wireless receiver chip. If done correctly, only the red (power) and the purple wire (ground) should be connected to the chip.



Ensure that the pink protective foam stays on the receiver. →



Step 4: Set both the wireless receiver chip and the wireless joystick to the exact same desired channel. Note: if you have received more than one wireless receiver chip along with only one wireless joystick then you must set each chip at a different channel and subsequently change the wireless joystick channel each time you connect to either tree spades.



Wireless Chip Wireless Joystick

Step 5: Once the channels are set the same and power is going to the wireless receiver chip you can turn on the wireless joystick. The lights shown here will start to blink once the wireless joystick has established a connection with the wireless receiver chip. If the lights remain constant, check the channels and check to be sure that power is going to the wireless receiver chip. Also, ensure that the wireless joystick has adequate battery life.



2 Operation

2.1 Wireless Operation

2.1.1 Turn On Procedure

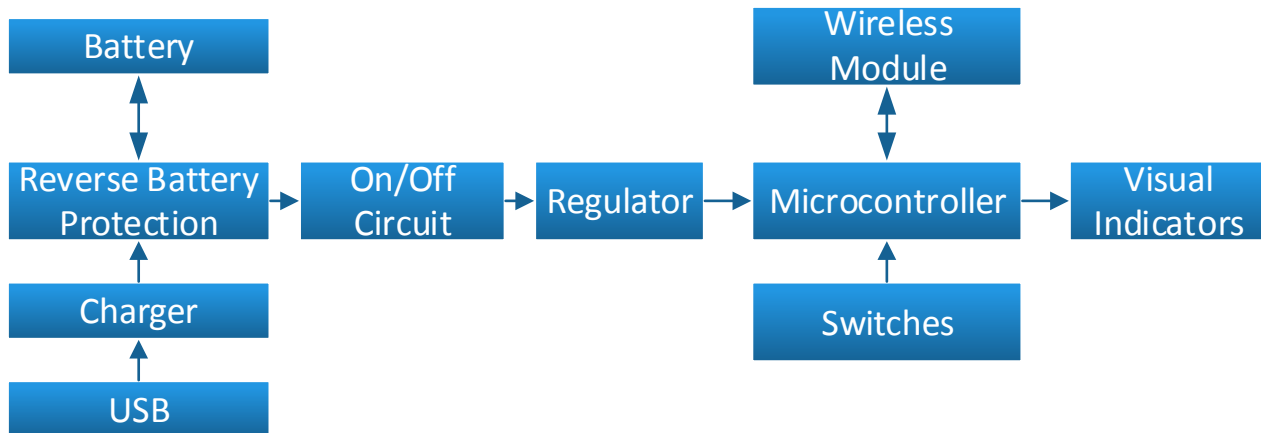
- 1) Turn off wireless spade receiver board and wireless pistol grip (Power LED will be off).
- 2) Set a channel on the wireless spade receiver board.
 - Spade systems on the same channel (in range of each other) will not interfere with each other once they are paired (lost on power down) but it will reduce the performance of the communication
 - Optimally select an unique channel for each spade that me be operated close to each other
 - Up to 16 (0-9, A-F) unique channels are allowed on the wireless spade system.
- 3) Set the channel on the wireless pistol grip board to match the wireless spade receiver board.
- 4) Power up the receiver board - typically done by turning on the entire system from the vehicle.
 - The Power LED should be constantly on to indicate it is getting power.
 - The Status LED should be flashing to indicate the program is running.
- 5) Turn on the wireless pistol grip by pressing the white “On” button.
 - The Power LED should turn on.
 - After a few seconds the Spade LED and Active LED on should both start flashing (Spade LED flashes faster than Active LED) to indicate the two boards have been paired for this session (until they are powered off then on again).
 - If the Active LED turns on and the Spade LED is flashing then the pistol grip has not connected to and receiver boards.
 - i. Check to see if the receiver and pistol grip are on the same channel
 - ii. Make sure both are off and the receiver boards is powered on first
- 6) The pistol grip and receiver board should now be paired and ready to use.
 - If none of the functions buttons or trigger are being pressed the pistol grip will eventually enter power saving mode where the Active LED is off and the Spade LED is pulsing (slower flashing).

2.1.2 Reconnect

- 1) After the pistol grip and tree spade are paired turning off the pistol grip and then turning it back on will continue as normal.
- 2) Restarting the tree spade board will disconnect it from the pistol grip until it is restarted as well.
 - Pistol Grip Active LED will flash since it will still be connected; however, the tree spade board Active LED will not flash since it will not accept the communication.

2.2 Wireless Pistol Grip

2.2.1 Block Diagram



2.2.2 Buttons/Switches

- **On:** Turns on the pistol grip board. Has no effect if the board is already on.
- **Off:** Turns off the pistol grip board. Has no effect if the board is already off.
- **Channel Select Rotary Switch:** Selects the wireless channel of the device. 16 Possible (0-9, A-F). Takes effect only after restarting the wireless pistol grip board.
- The following function buttons activate the following output (see section “2.4 Solenoid Driver” for machine specific output):

Table 1: Wireless Pistol Grip Function Buttons

Input	Spade Mode Output Function	Mast Mode Output Function
B1	1	N/A
B2	2	N/A
B3	3	N/A
B4	4	N/A
LG	5	N/A
RG	6	N/A
A1	7	N/A
A2	8	N/A
Mast	9	N/A
Spade	10	N/A
Backside Trigger	Inverts Above	Inverts Above

2.2.3 Connectors

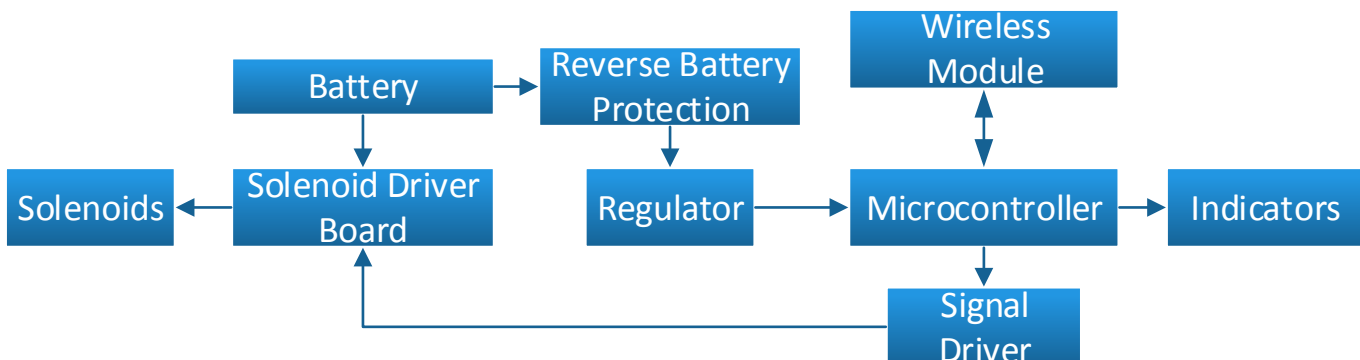
- **Mini-USB Type B:** Used to charge battery if it is not fully charged. The device can operate if
- **Backside 2-Pin Header:** Connector from the battery to give the board power.
- **Backside ICSP - 6-Pin Header:** Used to program the board microcontroller.

2.2.4 Indication LEDs (Lights)

- **Power LED:** On if the circuit board has power and turned on.
- **Charging LED:** On if the USB cable is connected and the battery is not completely charged.
- **Mast LED:** Flashing indicates that the functions buttons are mapped to Mast Control. Quick flashing indicates that the program is running in regular mode. Pulsing (slower flashing) indicates that the program is in power saving mode.
- **Spade LED:** Flashing indicates that the functions buttons are mapped to Tree Spade Control. Quick flashing indicates that the program is running in regular mode. Pulsing (slower flashing) indicates that the program is in power saving mode.
- **Active LED:** Flashing indicates successful communications between pistol grip and receiver board.
- **Low Battery LED:** The battery capacity is low and should be re-charged when possible. If the device is continued to be used for too long then the board will shut off all functions when the battery reaches a critical point and only the Power LED will be on and the low battery light will either flash or be completely off. If it is still on then the battery protection will disable the power when the battery is completely drained to prevent damage.

2.3 Wireless Tree Spade Receiver Plug-In Module

2.3.1 Block Diagram



2.3.2 Buttons/Switches

- **White Button:** Resets the circuit board. Only works if the Active LED is on or is flashing.
- **Channel Rotary Switch:** Selects the channel of the device. 16 Possible (0-9, A-F).

2.3.3 Connectors

- **ICSP - 6-Pin Header:** Used to program the board microcontroller.
- **2-Pin Horizontal Jack:** Accepts a 2-pin plug (or old 10-pin wired pistol grip plug) with power (12V).

- 10-Pin Vertical Plug: Plugs into the spade solenoid driver board to provide power and send signals.
- 2-Pin Vertical Plug: Plug into the new wired spade board for two additional signals to control solenoids.
- UART - 3-Pin Header: N/A.

2.3.4 Indication LEDs (Lights)

- Power LED: On if the circuit board has power.
- Status LED: Flashing shows the program is running.
- Active LED: Flashing indicates successful communications between pistol grip and receiver board.
- Blue On & White Off: Indicates the function is active (trigger not pressed)
- Blue Off & White On: Indicates the function is active in the reverse direction (trigger pressed).

2.4 Solenoid Driver

- The program in the microcontroller determines the function of the board to operate as a Tree Spade Board (Manifold/Sectional Valve), Truck Spade, Tree Rex or Tree Tyer.
- A label is placed on the board after programming to indicate the operation of the board.
- Each of the 21 outputs is designed for a solenoid operating at 12VDC or 24VDC and up to 3A continuous current (5A max).
- Each output should only have one coil connected for best performance.
- Only right most ground is necessary but all three ground usage is recommended for best performance.

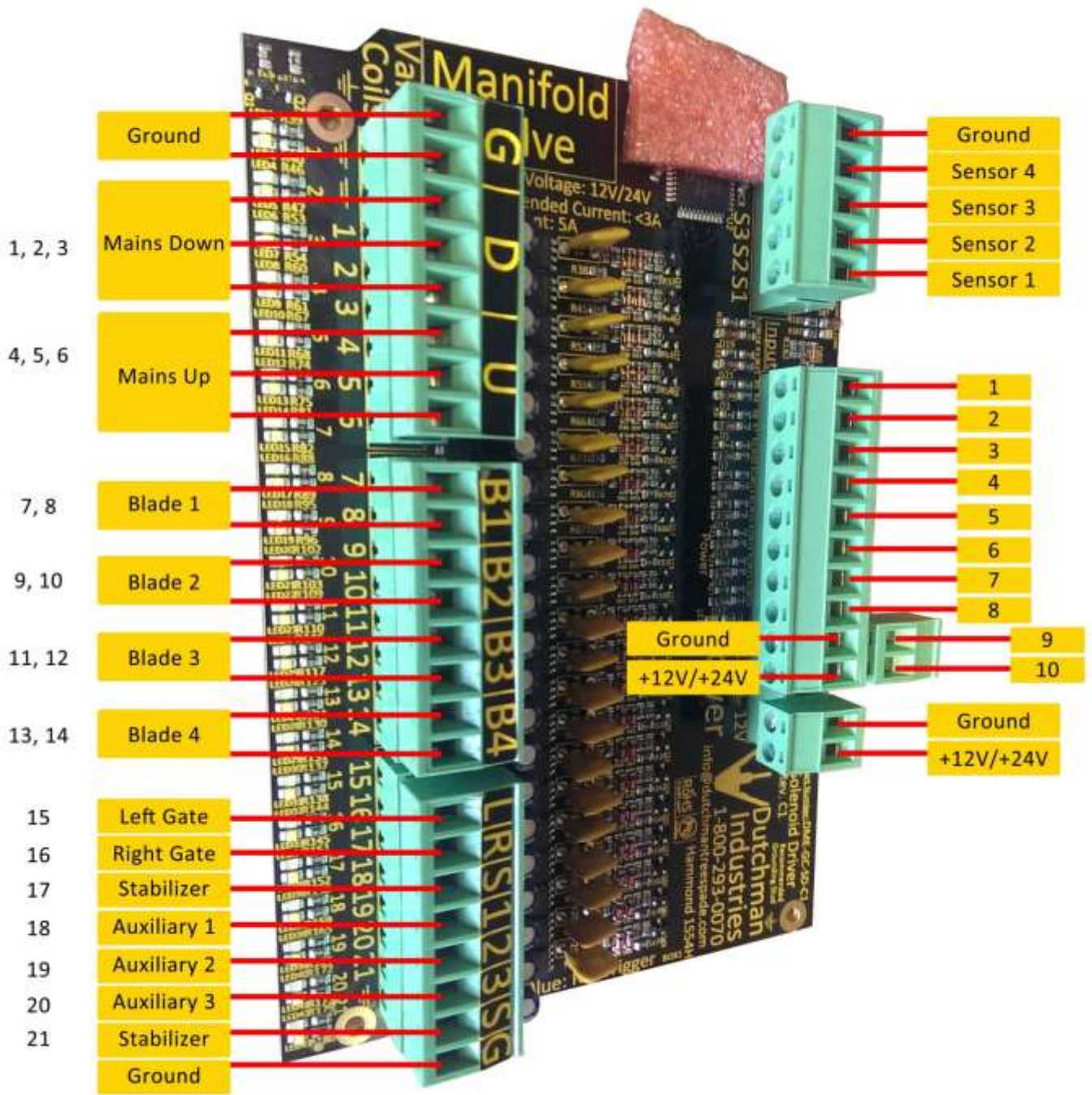
2.4.1 Tree Spade/Truck Spade

2.4.1.1 Manifold Valves

- Label: “Manifold Valve”
- Some functions have extra outputs than needed for backup.
- Output Allocation:

Table 2: Manifold Valve Board Function Assignment

Outputs	Input	Tree Spade Function	Truck Spade Function
1, 2, 3	Any (No Trigger)	Mains Down	Mains Down
4, 5, 6	Any (Trigger)	Mains Up	Mains Up
7, 8	1	Blade 1	Blade 1
9, 10	2	Blade 2	Blade 2
11, 12	3	Blade 3	Blade 3
13, 14	4	Blade 4	Blade 4
15	5	Left Gate	Left Gate
16	6	Right Gate	Right Gate
17, 21	7	Stabilizers	Gate
18	8	N/A	Aux
19	9	N/A	N/A
20	10	N/A	N/A

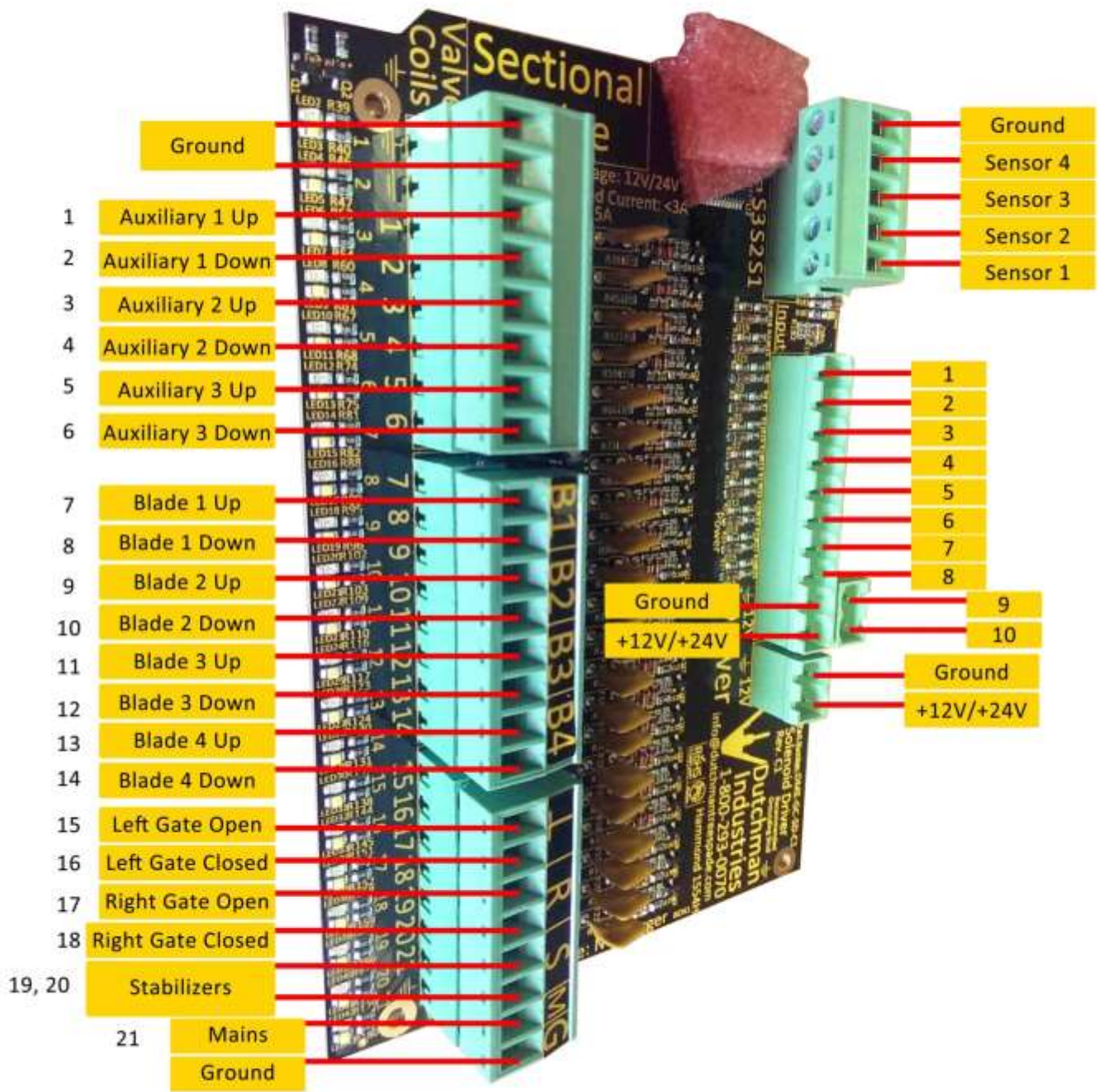


2.4.1.2 Sectional Valves

- Label: “Sectional Valve”
- Output Allocation: Wiring remains same for Main and Functions 1-7 from Helix board

Table 3: Sectional Valve Board Function Assignment

Input	Output (No Trigger)	Output (Trigger)	Tree Spade Function	Truck Spade Function
Any	21	21	Mains	Mains
1	8	7	Blade 1	Blade 1
2	10	9	Blade 2	Blade 2
3	12	11	Blade 3	Blade 3
4	14	13	Blade 4	Blade 4
5	16	15	Left Gate	Left Gate
6	18	17	Right Gate	Right Gate
7	20	19	Stabilizers	Gate
8	2	1	N/A	Aux
9	4	3	N/A	N/A
10	6	5	N/A	N/A

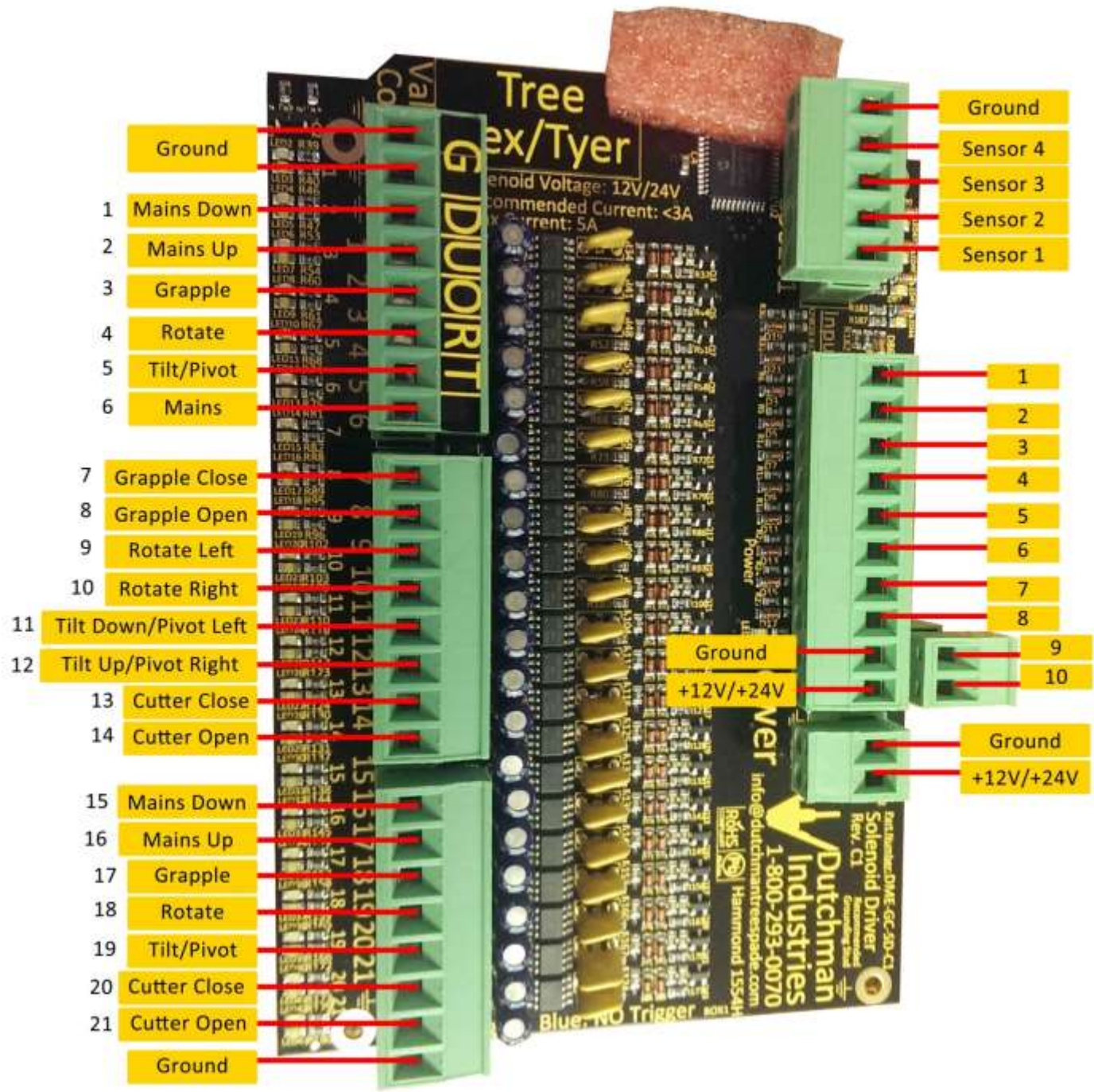


2.4.2 Tree Rex/Tree Tyer

- Label: “Tree Rex/Tree Tyer”
- Output Allocation:

Table 4: Tree Rex/Tree Tyer Board Function Assignment

Input	Outputs	Tree Rex Function	Tree Tyer Function
1-6	6	Mains	Mains
1,2,6	1,15	Mains Down	Mains Down
3,4,5	2,16	Mains Up	Mains Up
1	3,7,17	Grapple Close	Gate Close
2	4,9,18	Rotate Left	Rotate Left
3	4,10,18	Rotate Right	Rotate Right
4	3,8,17	Grapple Open	Gate Open
5	5,12,19	Tilt Down	Pivot Left
6	5,11,19	Tilt Up	Pivot Right
7	13, 20	-	Cutter Close
8	14, 21	-	Cutter Open



2.4.3 Buttons/Switches

- Reset: Resets the microcontroller program. Holding the button will disable the microcontroller which disables all the outputs.
- Input: Unused.

2.4.4 Connectors

- ICSP - 6-Pin Header: Used to program the board microcontroller.
- 2-Pin Vertical Jack - Power: Labeled with ground symbol and 12V. Second plug to feed power directly from the battery and bypass pistol grip. If using Wireless Receiver Module, the power will plug into it instead of this jack.
- Pistol Grip Input - 10-Pin Vertical Jack: Standard Pistol Grip (no change from Helix board) input with 8 functions and 12V & GND. Significant power is lost when routing through pistol grip for manifold valves. Powering separately will transfer power to pistol grip as well. Wireless Receiver Module will plug into this jack.
- 9/10 Function - 2-Pin Vertical Jack: Extra plug to activate 9th and 10th functions. Wireless Receiver Module will plug into this jack.
- 3x 8-Pin Jack: Provides outputs and ground paths for solenoids depending on the program. Grounds are labeled with a ground symbol. The 1-21 outputs will activate according to the program.
- 4x Mounting Holes: The mounting holes are grounded which provides an alternative to using ground on the plugs. The recommended mounting hole usage order is: Top Right, Bottom Right, Bottom Left, Top Left.

2.4.5 Indication LEDs (Lights)

- Power LED: On if the circuit board has power.
- Status LED: On if the microcontroller program is running.
- Red On & Green Off: Indicates the output is active (trigger not pressed)
- Red Off & Green On: Indicates the output is active in the reverse direction (trigger pressed).
 - There are 21 pairs of Red/Green LEDs – one for each output.

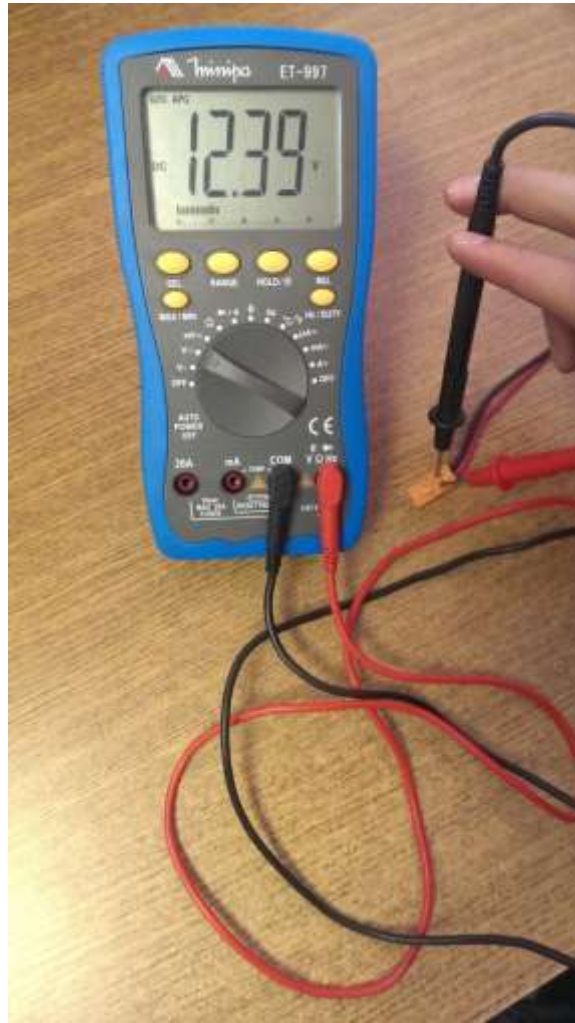
2.5 Trouble Shooting

- Wireless does not work
 - Make sure Power LED on Receiver Board and Pistol Grip board are both on

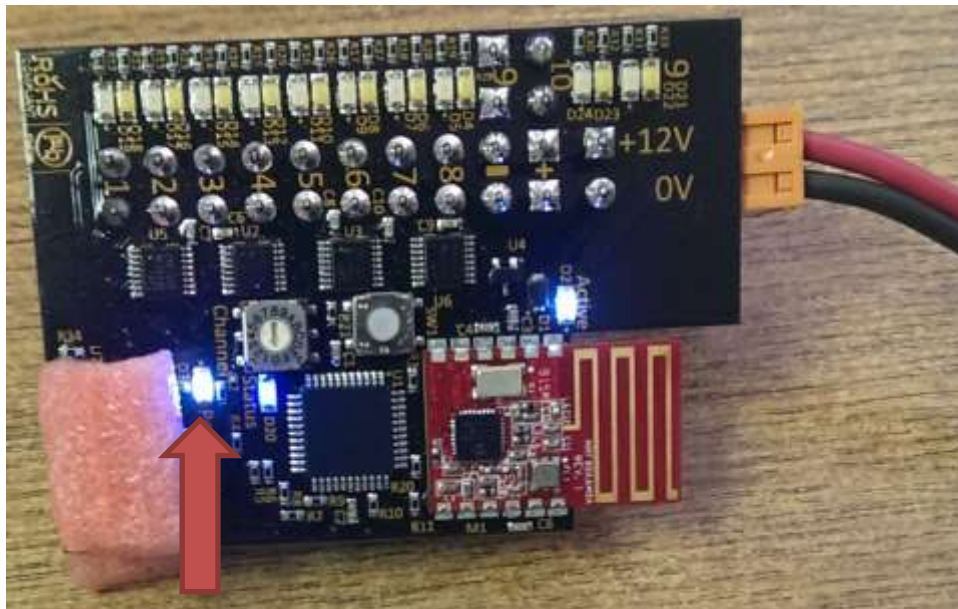
- Pistol Grip Board does not turn on (no Power LED) when button is pressed:
 - Check if battery is inserted correctly (positive button is down).
 - Check if battery wire is connected properly to the circuit board.
 - Check battery voltage.
 - Above 3.0V is within operating range.
 - Between 2.5V and 3.0V is where the circuit board will not active (Power LED will be on).
 - If it is 0V then the battery is completely discharged.
 - If this is the case on a brand new battery then it may be damaged. It should be fully charged then left idle for one day. If the battery is above 4.1V then it is not damaged.
- Receiver Board does not turn on (no Power LED)
 - Check if the power plug is receiving power
 - Check if power is connected properly (On the 2-Pin horizontal plug the 12V/Hot goes to the left pin looking from the top and Ground/0V/Return to the right pin looking from the top)
 - Do plug the receiver board into the solenoid driver:
 - No Power LED: Power not getting to the board
 - Power LED turns on: Solenoid Driver may be damaged or cables may be pinched
 - Power LED is on pistol grip and receiver but the Active LED is not flashing
 - Make sure the selected channel is the same on the pistol grip and receiver
 - Make sure to turn on the pistol grip after turning on the receiver board first
- Wireless works but the spade functions do not work
 - If Active LED is flashing on pistol grip and receiver and the function LEDs light up when the buttons are pressed make sure the LEDs on the solenoid driver board light up as well
 - If the lights on the solenoid driver light up then the circuit board is fine but the solenoid may not be connected properly
 - When the function lights are on check to see if the solenoid is magnetized

2.5.1 Detailed Trouble Shooting

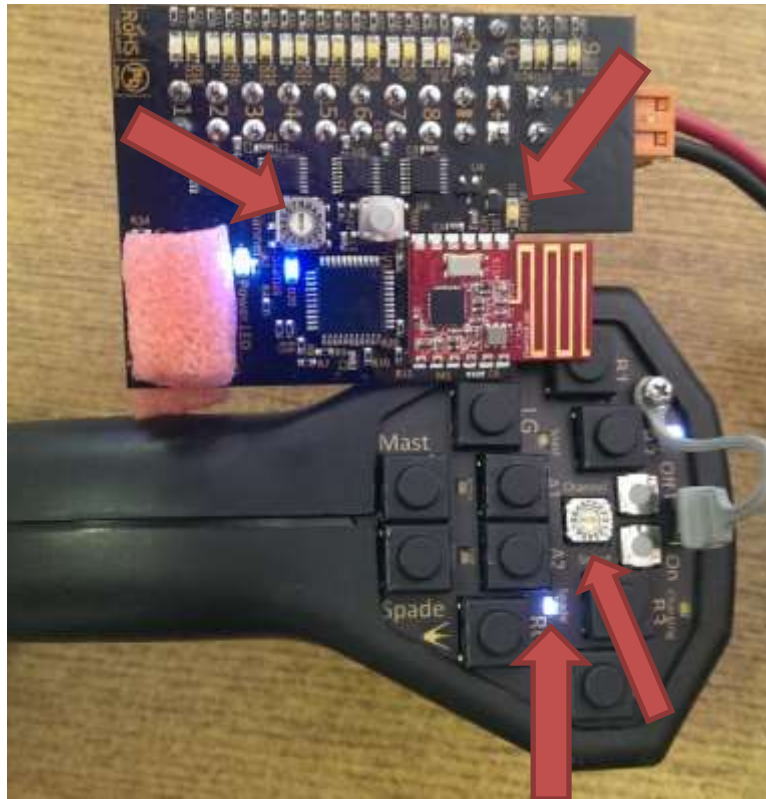
- 1) Measure voltage on the plug and make sure it is installed the correct way.



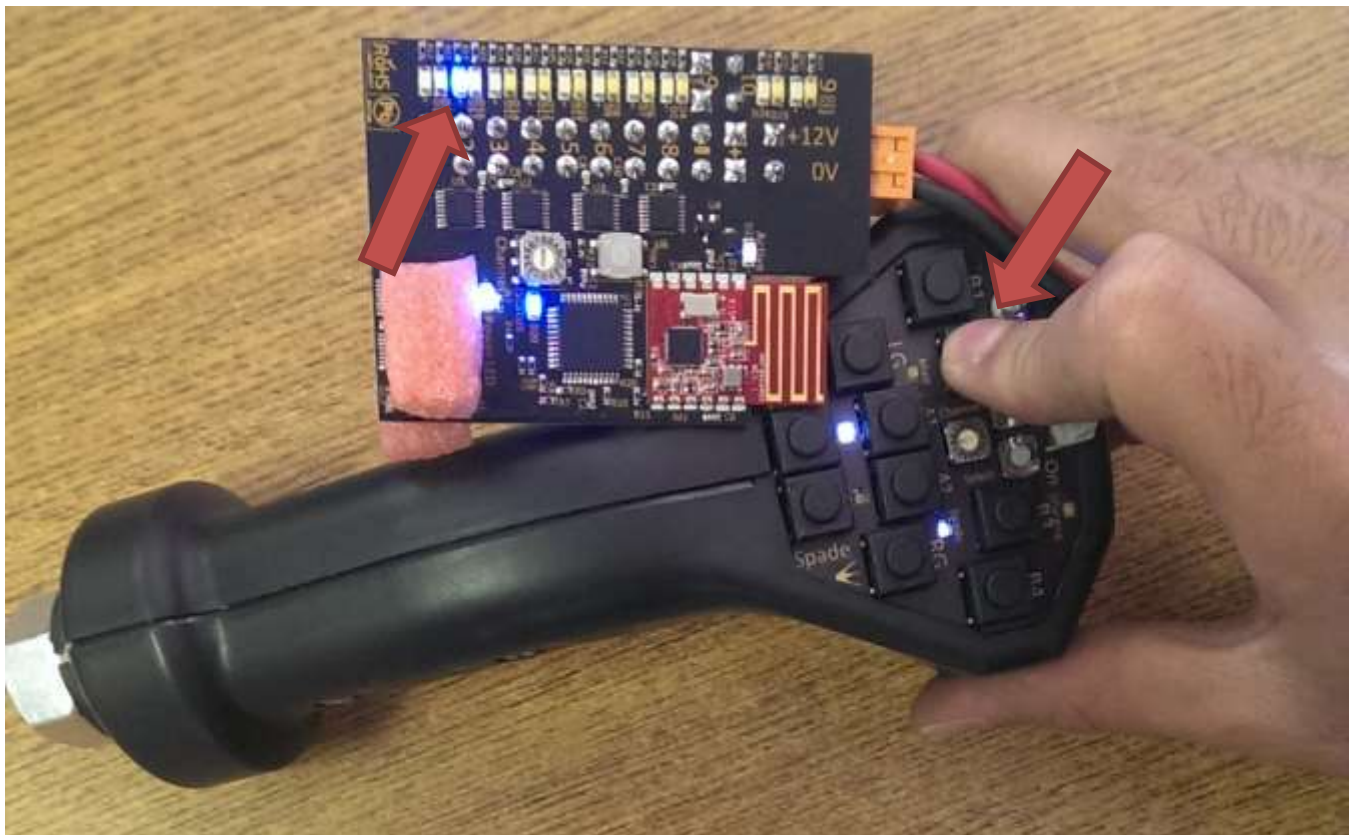
- 2) Plug into just the wireless receiver and check for power (Power LED on).



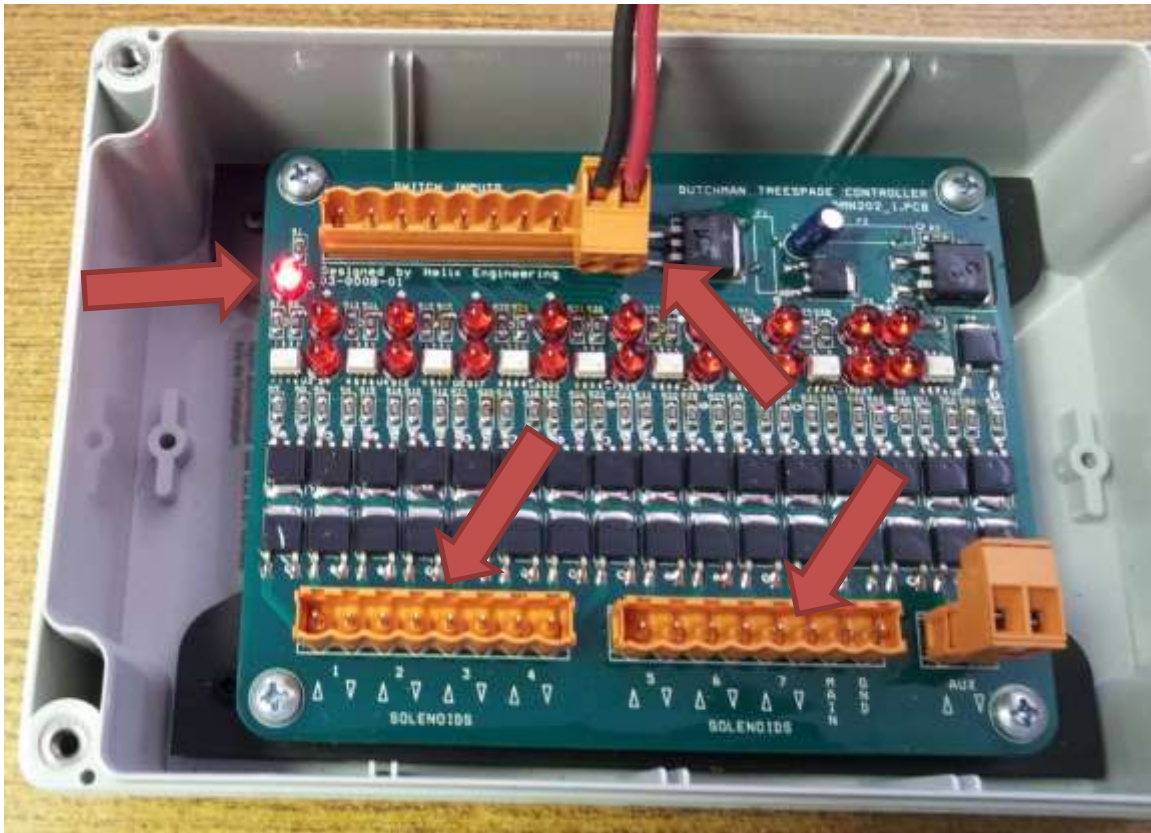
- 3) Turn on pistol grip and check for communication (Active LED flashing on the receiver and Spade LED flashing on the pistol grip) – check channel as well.



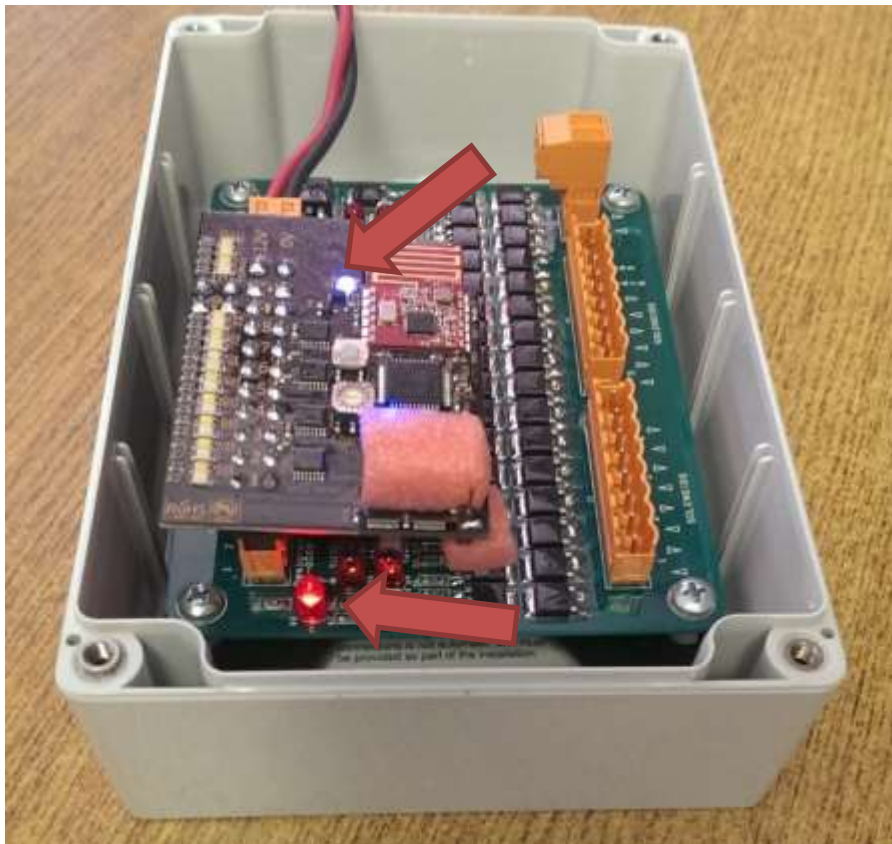
- 4) Press Blade 1, then Blade 1 + Trigger, then Blade 2, then Blade 2 + Trigger and so until all functions are tested.



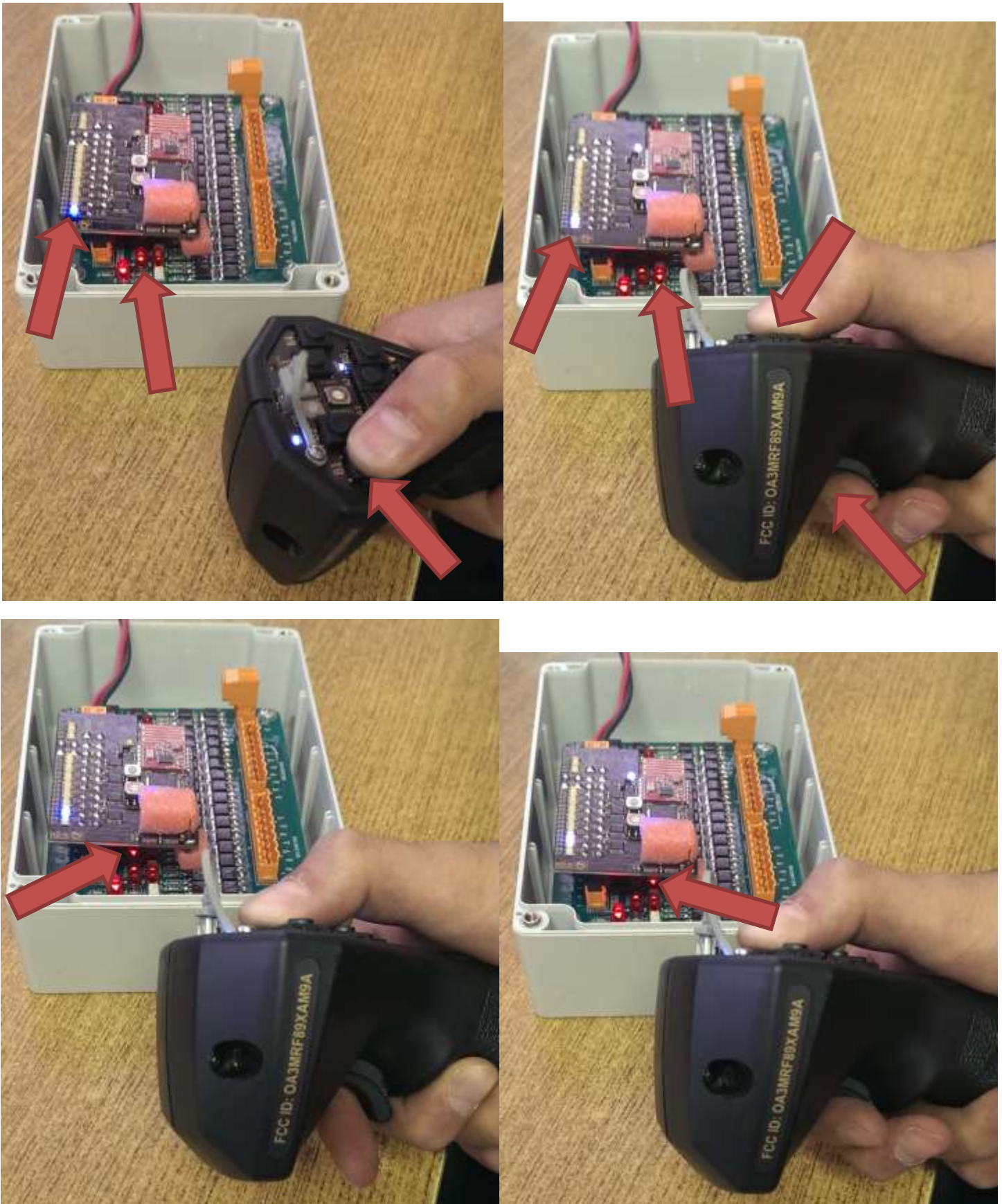
- 5) Remove the coil plugs from the driver circuit board and apply power directly to using the plug from the wireless receiver and check for power.



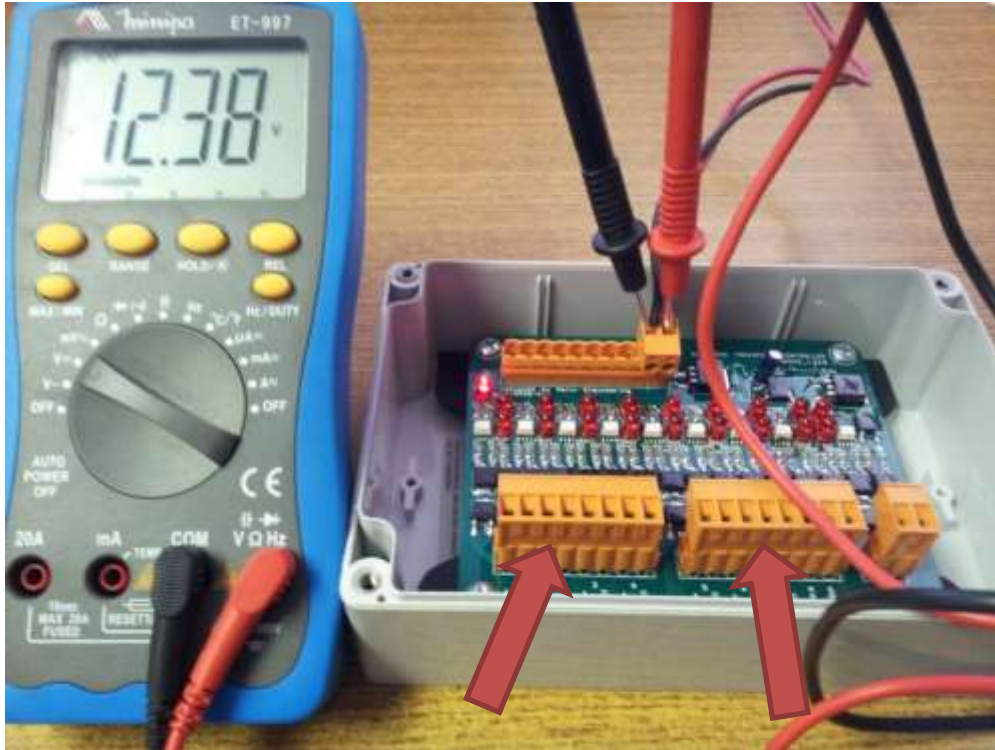
- 6) Install the wireless receiver (pistol grip should be off) and check for power.



7) Connect pistol grip by turning it on and test all functions. The lights should turn on the receiver and the driver board when the buttons are pressed.



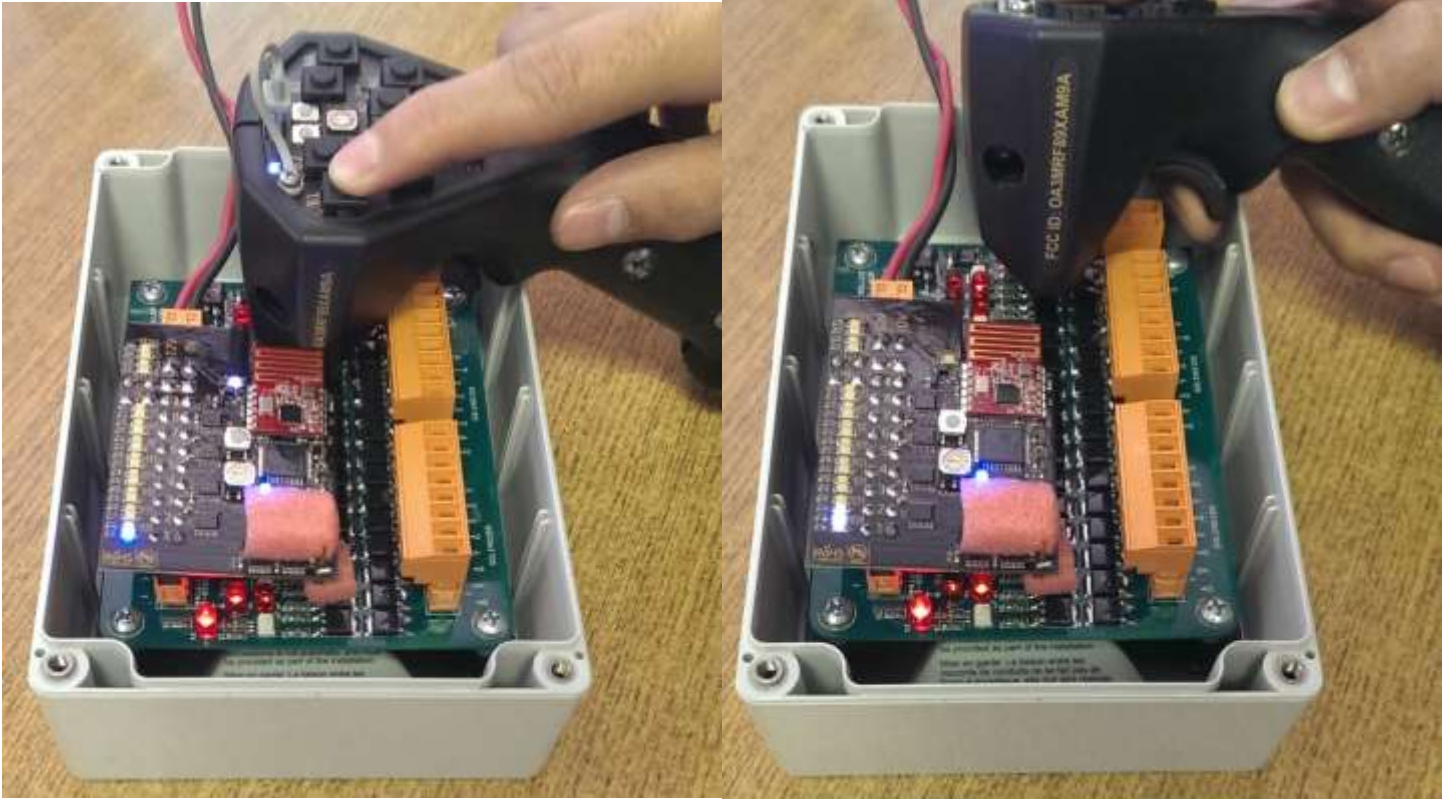
8) Remove the wireless receiver; plug the coils back in, power up the driver board and check the voltage.



9) Install the wireless again (pistol grip should be off) and check for power.



10) Test all functions again (with and without trigger) and check to see if coils are energized which can be done by checking if a piece of metal stick to a coil when it is activated.



3 Wireless Regulatory Approval

3.1 Wireless Frequency Identification

All wireless boards can be assembled with a frequency of 868MHz (Europe), 915MHz (North America) or 2.4GHz (Universal). The frequency is determined by the red wireless module. The markings on the modules to identify the frequency are (and shown in “Figure 1: Wireless Module Identification Diagram”):

- 868 MHz Module: “MRF89XAM8A”, “868”
- 915 MHz Module: “MRF89XAM9A”, “915”
- 2.40 GHz Module: “MRF24J40MA”, ‘E’/‘M’ Gold Antenna

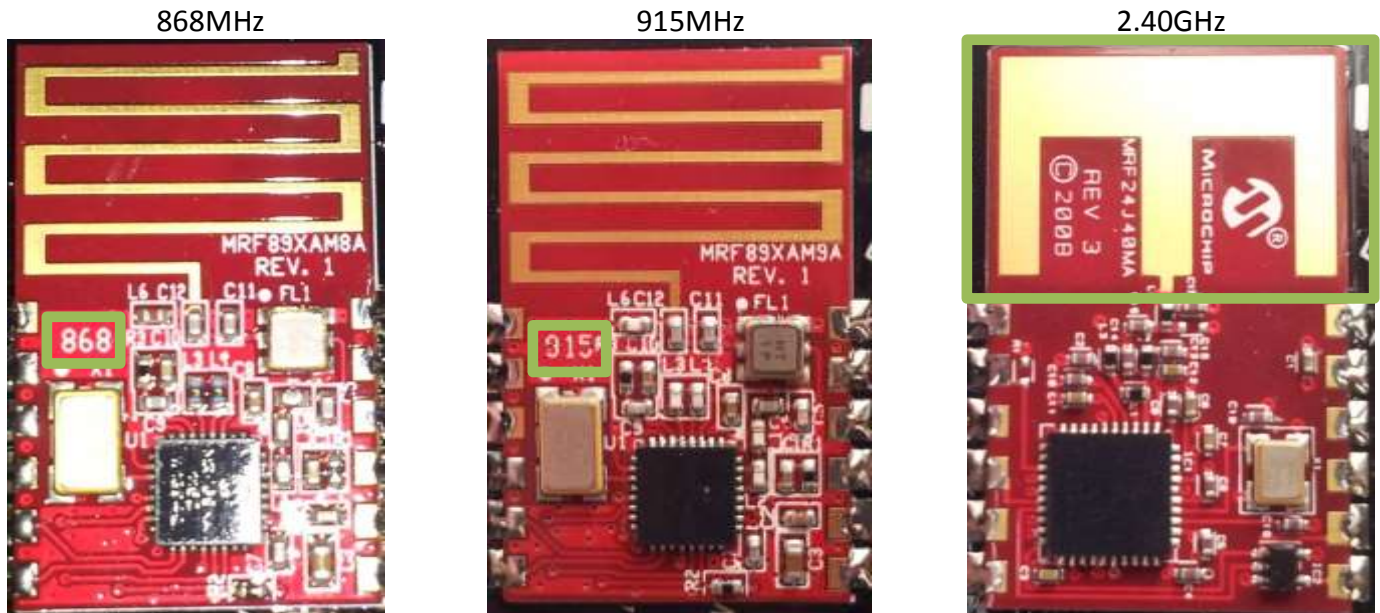


Figure 1: Wireless Module Identification Diagram

3.2 902/915MHz (North America): MRF89XAM9A

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment OFF and ON, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.3 868MHz (Europe): MRF89XAM8A

3.4 2.4GHz (Universal): MRF24J40MA

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

4 Lithium-Ion Battery Safety

Please be sure to save, read and follow these instructions carefully! This safety sheet provides important basic information on the handling and use of LITHIUM-ION batteries. If for any reason the required safe handling cannot be followed, please refrain from using LITHIUM-ION batteries.

4.1 Safe Charging

- To charge, simply place the battery in the charger, observing polarity. The LED will light RED when charging and GREEN when ready to use
- Remove the battery as soon as possible after the LED illuminated GREEN. LITHIUM-ION cells should never be kept "topped off" on the charger.
- Never attempt to "top off" or otherwise charge a fully charged battery
- Always charge LITHIUM-ION cells with the recommended charger or personal harm and property damage may occur.
- Always use chargers specifically approved for use with your LITHIUM-ION packs.
- Always test your charger to assure it is functioning properly.
- Always charge your LITHIUM-ION cells on concrete at least 10 feet (3 meters) from any combustible materials.
- Never leave the charger unattended while batteries are connected. Over-charged batteries can explode.
- Always store LITHIUM-ION cells or packs in a fireproof container.
- Always have sand or dry fire extinguisher handy in the event of fire.
- Always keep all batteries out of the reach of children and animals.
- Always observe the correct polarity when connecting cells or packs to charger or application.
- Always seek medical attention if electrolyte gets in your eyes (flush with cold water immediately).
- Always scrub with soap and water if electrolyte comes in contact with your skin.

4.2 Safe Handling

- Never charge LITHIUM-ION cells or packs unattended.
- Never charge LITHIUM-ION beyond factory specifications; this is dangerous and strictly prohibited.
- Never charge LITHIUM-ION in your car, home or garage or where other physical damage can occur.
- Never charge LITHIUM-ION while in the application as the hot pack may ignite certain materials.
- Never charge LITHIUM-ION on flammable materials such as wood, foam or plastic.
- Never disassemble a LITHIUM-ION cell or pack.

- Never short circuit LITHIUM-ION cells or packs.
- Never use a LITHIUM-ION cell or pack that has been damaged.
- Never put them in your pocket, purse, bag, desk drawer, etc.
- Never keep cells or packs in temperatures that exceed 60C/140F.
- Never exceed the factories maximum allowed charge and discharge rates.
- Never combine different cell sizes or capacities together in the same pack.
- Do not allow cells to self-discharge to an open-circuit voltage of less than 2.6V

4.3 Safe Storage

- Do store cells in a cool, dry and secure environment ensuring that the formation of condensation is prevented.
- Do not throw the cell into a fire, or place it in an oven, stove, microwave oven or near sources of heat.
- Do not handle or store cells in such a way as to allow contact with any metal objects such as hairpins, rings or clips.
- Do not drop or throw the cell, or subject it to excessive impact or shock.
- Do not pierce, strike or crush the cell, or attempt to damage or deform it in any way.
- Do not allow the cell to come into contact with water, aqueous solutions or any other liquids.
- Do not attempt to disassemble or modify the cell in any way, as the design safety features could be compromised.

4.4 Safe Usage

- Do use LITHIUM-ION cells of the same size, age, state-of-charge and, wherever possible, batch code in any one battery assembly.
- Do incorporate appropriate electronic protective circuitry to prevent over-charge, over-discharge and over-current, at battery level, in conjunction with inherent battery cutoff circuitry.
- Do ensure that cells are connected with the correct polarity in battery assemblies.
- Do not use cells which are leaking (liquid on the outside of the cell or a solvent smell), or which feel hot or appear damaged in any way.
- Do not use LITHIUM-ION cells in combination with other cells of different chemistry, capacity, size or manufacturer.
- Be aware of the battery level during usage. If the light dims, stop using and replace/recharge the battery. An over-discharged battery may explode, despite safeguards.

4.5 Damaged Battery Packs

- Before each use totally inspect the cells, wire leads and connections for possible short circuit.
- If there is any doubt completely cut all wires from the pack.
- If any cells are dented or deformed do not use the pack.
- Follow disposal notes below.

4.6 Disposal Battery Packs

- If the LITHIUM-ION pack is damaged, immerse it in salt water with plastic container for two weeks to discharge the battery pack. Use 1/2 cup of salt per gallon of water.
- If the LITHIUM-ION pack is not damaged, discharge it to 1V per cell.
- You may use a 150 ohm 2W resistor (from The Source or other supplier), or connect it to the device and run it until the discharge voltage is observed.
- Apply tape over all electrical terminals and exposed sections.
- LITHIUM ION batteries are environmentally safe for landfill disposal.

4.7 Hot Batteries

- If a cell, either separately or in a battery assembly, is discovered to be at a higher temperature than normal, it should be carefully removed to a 'safe place' as soon as possible. Protective clothing such as thick gloves and facemask should be worn to carry out this operation, preferably with the cell being picked up with tongs.
- A 'safe place' is where the release of electrolyte or even flame from the cell will not cause personal injury or damage to property, e.g. an outside isolated position; buried in sand, soil or vermiculite; or inside a special-purpose, fire-proof container with non-conductive surfaces. After a period of two hours or more, the cell should be recovered and dealt with as a cell with abnormal characteristics, as described below.

4.8 Fire & Vented Cell

- For any cell that is found to have vented, the procedure for a hot battery (see above) should be followed.
- For any fire involving LITHION ION cells, dry chemical, CO₂ or copious water spray should be used to prevent the fire spreading. For large quantities of cells, use self-contained breathing apparatus and full protective clothing.

4.9 Cell with Abnormal Characteristics

- If a cell, either separately or in a battery assembly, is emitting an ether-like odour, or is discoloured, misshapen or corroded and it has an open circuit voltage (OCV) of 4.4V or less, it should be discharged in a controlled manner.
- Discharge cells by connecting a suitable load resistor (e.g. 150 ohm 2W resistor) between the cell terminals and allowing the cell to discharge for a minimum of 24 hours to 1V. The cells can then be safely disposed of.

The storage, safety and handling instructions contained on this sheet identify the basic storage and handling requirements in regard to the specified product and is not designed to be comprehensive. Dutchman Industries accepts no responsibility or liability in regard to any use of and I or storage of the products which in any way departs from these instructions.