Modified ATV Operator’s Manual

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Important Safety Instructions

General Warning

- TO REDUCE THE RISK OF INJURY, ADULT SUPERVISION IS RECOMMENDED. AVOID ROADWAYS, OTHER MOTOR VEHICLES, ON STEEP INCLINES AND STEPS AND BODIES OF WATER. THIS VEHICLE IS NOT DESIGNED TO SUPPORT MORE THAN ONE RIDER.
- This product is meant for outdoor use and on private property only.
- Any rider who does not fit comfortably fit in the vehicle and/or are unable to comfortably use the controls should not use this ATV.
- Never use this vehicle around the vicinity of small children who may enter your vehicle’s path.
- The ATV is intended for riders that are less than 130 pounds and for ages 3-7. Any more than this designated weight and the ATV may not operate as intended.
- This ATV is designed to run on off-road surfaces such as grass and packed dirt.
- Use of this ATV must be done with the permission of a directly supervising adult. It is the responsibility of the supervising adult to read and acquire a full understanding of the contents of this owner’s manual before use.
- This ATV is not designed to pull any mass behind it as this will result in possible damage to the motor or other internal components.
- Never immerse any part of the ATV in water and avoid use during inclement weather as moisture can be detrimental to the motor, switches and steering servo components.
- Never operate this ATV while using cell phones, pagers or headphones.
- Avoid riding on extreme inclines, declines and rocky surfaces. This vehicle is not designed for stunt riding, ramp jumping, mounting curbs and other such activities.
- Do not operate the vehicle in R/C mode with weak batteries as it could result in reduced range and/or possible loss of control.
- If using RC mode, make sure that the trim values on the controller are all set with the arrows in the upward position. Otherwise the steering alignment will be skewed.

Electric Hazard Warnings

- This is an electrically operated vehicle and should be operated with care. Keep away from small children.
- Before riding, always make sure that the battery connection is snugly fit with its counterpart.
- Ensure that the vehicle is stored in a cool, dry place. Exposure to extreme temperatures may cause the batteries to explode/malfunction.
- Before using the charger, make sure it is in full working condition. Do not use the charger if it has been damaged or modified in any way. A damaged charger can harm the electrical system and be a potential fire hazard.
• Never modify the electrical system in any way. Modifications of these systems without proper electrical knowledge can result in fire, serious injury, and damage to the electrical components.
• Ensure that the vehicle and battery chargers remain dry at all times. Never allow the battery charger to become wet or immersed in water.
• Never use replacement parts which have not been approved by the makers of the ERacer. Failure to do so may result in overheating, fire, or explosion.
• Use only the charger that is supplied with this vehicle. Use of the wrong type of battery or charger could result in a fire or explosion and lead to serious injury.
• Keep the battery away from children. It is to be handled by adults only. The batteries are heavy and contain a lead-acid electrolyte. Dropping the batteries can result in injury.
• Charging the battery must be done by adults only. Never allow children to recharge the battery.
• Ensure that all battery contacts and connectors are not damaged in any way.
• If any sign of damage is detected, do not use the chargers or batteries until you have replaced the worn or damaged part.
• Make sure that the toggle switches for the two different modes of operation are both switched in the same direction to ensure one mode of control only.

Battery Charging Warnings

• Charge the battery in a clean and dry indoor environment.
• Use only the type of battery specified by the manufacturer.
• Use only the provided chargers to charge the batteries.
• Keep the battery upright during charging.
• Do not short circuit the battery and its connectors.
• The recharge duration time under normal conditions is approximately 8 hours.
• Respect the polarity +/-.
• Do not allow the batteries to be in contact with metal parts (risk of fire or explosion).
• Always disconnect the battery if the ATV is not in use for a long period of time.
• Never attempt to charge batteries that are not rechargeable.
• Dispose of dead batteries into appropriate containers provided for their recycling time.
• You should only plug the chargers directly into a standard electrical wall outlet. Do not connect the chargers to a surge protector.

Battery Care Warnings

• THE LIQUID AND CONTENTS OF THE BATTERIES ARE HIGHLY ACIDIC. IF A BATTERY IS LEAKING AND THE LEAKING MATERIALS COME INTO CONTACT WITH YOU HANDS, FACE OR EYES, OR IS INGESTED, CALL A PHYSICIAN IMMEDIATELY.
• Charge the battery after each use to ensure longer battery life.
Never leave the battery in an uncharged condition. This will permanently damage it and prevent them from being able to hold any charge.
Avoid running the batteries completely dead as this will greatly shorten their usable life span.
Never charge the batteries for more than 30 hours.
Avoid extreme temperatures and do not store the battery in temperatures above 122°F or lower than 32°F.
Disconnect the battery if the ATV is to be stored for more than 2 months.
Check to make sure the battery is secured in place before riding the vehicle.

Riding Warnings

Do not ride the ATV at night to ensure optimal visibility.
Keep hands, face, feet and hair away from all moving parts.
Ride the ATV on as level ground as possible. The ATV can reach unsafe speeds and result in loss of control.
Do not operate this vehicle while using headphones or a cell phone.

Pre-Use Warnings

Look over the entire unit to make sure that there are no visible problems with the ATV.
Check that all cables and wires are not frayed, cut or broken.
Check for any loose nuts, screw and bolts.
Ensure that seat belt is properly secured and tightened across the rider’s waist.

Parts and Accessories

Front Grill

Front Cover

Front Wheels
• Rear Wheels

• Seat Assembly

• Seat Belt

• ESC

• Joystick

• Switches
- 12 Volt Battery

- 12 Volt Battery Charger

- Steering Servo Assembly

- Left and Right Motors

- Left and Right Gear Box

- RC Transmitter and Receiver
Features

- Joystick and Remote Control Modes

*Joystick control on center console*

*Remote Control ~ Transmitter and Receiver*
Proportional joystick allowing for variable acceleration, braking and steering
  - Allows for finer control of the ATV

• Three point safety belt

Three point restraint

• Seat with lumbar support

Cushioned seat with side and back supports included for user’s comfort and safety
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1. Introduction

1.1 General Overview

The ATV for this project originated from a battery powered quad that had been modified to meet the client’s needs. In its original factory state, the client was not receiving any lumbar support from the original saddle seat. In addition to this, he also had great difficulty manually steering the vehicle with the handlebars. To help ameliorate these issues, joystick control and a lumbar support seat was implemented in addition to a remote control option for the client’s mother.

1.1.1 Steering Servo Assembly

The steering assembly consists of a SPG805a Standard Rotation Servo Power Gearbox with a 5:1 gear ratio shown if Fig. 1 below.

![SPG805a Steering Servo](image1)

**Figure 1. SPG805a Steering Servo**

This particular part controls the tie rods by translating rotational motion into linear motion that in turn moves the tie rod in either direction. Two 1” aluminum tubing served as the servo housing which was bolted to the chassis. A double bar linkage system secured by locknuts was used to attach the steering servo to the tie rod. Figure 2 delineates how this is set up.

![SPG805a Steering Servo Assembly](image2)

**Figure 2. SPG805a Steering Servo Assembly**
1.1.2 Joystick Steering

The steering joystick is used to steer the ATV when the vehicle is in joystick mode. This commands the servo discussed above to turn in either direction based on user input as shown in fig. 3 below. A nylon joystick handle was created using a lathe machine and superimposed upon the smaller joystick handle that the client would have difficulty grasping.

![Joystick control](image)

*Figure 3. Joystick control*

1.1.3 RC Steering

This is the second user selectable mode of steering. Through the use of a transmitter and receiver, commands are sent out and accepted by the receiver that in turn tells the steering servo to rotate in the direction the user wishes. This is demonstrated in fig. 4.

![User demonstrates the turning of the wheels through RC control](image)

*Figure 4. User demonstrates the turning of the wheels through RC control*
1.1.4 Toggle Switches

Two possible modes of operation are available on a user selectable basis. To toggle between the two modes, two SPDT switches were installed on the center console where it can easily be accessed if the user decides to switch modes of operation. These switches are shown in fig. 5 below.

![Figure 4. Mode of operation toggle switches](image)

1.1.5 Seat

It was requested by the client’s mother that there be a seat with a safety harness that offered lumbar support. The seat implemented on this vehicle offers both cushioning, lumbar support and side supports. The seat was mounted onto the chassis using 6x12 and 6x4 aluminum plates of approximately ¼” thickness. The rear of the seat was bolted to the 6x12 plate and this was secured through the chassis and onto the 6x4 plate and tightened using washers, screws and nuts. The front of the seat was secured by Velcro straps pulled tightly to minimize movement. Figure 5 and fig. 6 illustrates this.

![Figure 5. Mounted seat ~ front secured by two industrial grade Velcro straps](image)  
![Figure 6. Rear of the seat secured by aluminum plates](image)
1.1.6 Restraints

The ATV has a three point safety harness that is attached to the seat bolted to the chassis. This can be seen in fig. 7 below.

![Figure 7. Three point safety belt](image)

1.1.7 Motors

This vehicle runs on two motors from Peg Perego in the rear of the ATV. The motor used is shown in fig. 8 below.

![Figure 8. One of the two motors used in this vehicle](image)

1.1.8 Electronic Speed Controller

The electronic speed controller or ESC is an electronic circuit that serves the purpose of varying the speed at which the electric motors run at. The ESC used in this ATV allows for much smoother and more precise variation of motor speed in addition to forward and reverse controls. Traxxas EVX-2 is the ESC employed in this vehicle and incorporates a battery eliminator circuit to regulate the voltage for the receiver and thereby removing the need for receiver batteries. The ESC is shown in the figure below.
1.1.9 Battery

The ATV has one rechargeable lead-acid battery in the center of the vehicle. It is a 12 volt battery which is used to power the motor, and all auxiliary electronics. It is shown below in fig. 10 below.
1.2 Making the Modified All-Terrain Vehicle Operational

Before the ATV can be used, certain steps must be taken to set up the vehicle:

1) Connect the battery plugs at the center of the ATV to feed the power. This can be seen in Figure 11 below.

![Figure 11. Battery plugs](image1)

2) Check that all nuts, bolts and screws are tight, especially those shown below.

   a) Any nuts and bolts associated with the seat attachment. This can be seen in fig. 12 below.

![Figure 12. Nuts and bolts of the seat attachment that must be checked before use](image2)
3) Find the ESC within the center of the vehicle and press the on button to power up the ESC. Hold the button until the green led is lit. The star designates the location of this power button in fig. 13 below.

![ESC power button](image)

**Figure 13. ESC power button**

### 1.3 Instructions for Use of the Device

1) Ensure that all the steps mention in the previous section (*Making the Modified All-Terrain Vehicle Operational*) are carried out.
2) Make sure that the mode of operation switches are in the center position so as to ensure that when the rider mounts the vehicle, it does not move.
3) Ensure that the safety straps are tightly secured around the rider and that all limbs are in their proper place.
4) Decide which mode of operation is desirable. If the mode wanted is RC control, then toggle both switches to the right. If the mode desired is joystick control, toggle both switches to the left.
5) With RC control, turn on the unit by pressing the power button. A red led should light up to signify that the power is on. Grip the control in either hand and use the other to control the wheel as shown in fig. 14.
6) If the mode of operation chosen is joystick control, make sure the rider grip the joystick handle firmly, as the movements of the ATV can cause unwanted movements in the joystick which can translate into sporadic and possibly dangerous movements by the vehicle. Fig. 15 shows proper gripping of the joystick handle.

**Figure 14. Use of the pistol grip remote control unit**

**Figure 15. Proper gripping of the joystick handle**
2. Maintenance

2.1 Battery

Check batteries before riding. Make sure to charge your batteries for 18 hours to initiate them, before riding. Failure to do this will result in permanent battery damage. While keeping this in mind, only adults should recharge batteries. Never allow children to recharge batteries. Children should never be allowed to handle batteries at any given time. If replacing batteries, remember to use the batteries specified by the manufacturer. New batteries should never be mixed with old batteries. It is recommended to have back-up batteries on hand that is fully charged. Do not make direct contact between battery terminals, as this can cause an explosion or fire. Make sure to charge batteries in a well-ventilated area away from sources of heat and flammable materials. Remove exhausted batteries from vehicle, when applicable. Do not place the batteries near clothing to avoid damage.

Note: Before disposing batteries, you must contact your local environmental protection agency office for more information.

2.2 ATV

Check the conditions of the vehicle. These conditions may include electrical system, plug connections, and the charger. Make sure everything is intact, not loose or damaged. In case of fault, do not try to charge the vehicle, using the charger. For repair use, only use original PEG PEREGO’s spare parts, since PEG PEREGO assumes no liability if the electrical system is tampered with. Avoid leaving the vehicle or batteries near sources of heat, such as radiators, stove, and fireplaces. Keep vehicle protected from conditions such as water, rain, snow and etc. Precautions are required when operating in overload conditions, such as soft deep sand, mud or rough uneven terrain. In such cases, the vehicle cannot handle the overload conditions. Check moving parts and make sure to lubricate the parts. These parts include wheel bearings, steering linkages, especially areas where they rotate or touch one another. An adult must clean vehicle’s surface with a dampcloth. Avoid using abrasive cleaners. Never disassemble the vehicle mechanisms or motor. Check the fastening studs to be sure they are tight.

Note: Although vehicle can be operated on grass, dirt or hard surfaces, never allow this vehicle to be used on streets, around traffic or parked cars.

2.3 Remote Control (RC) System

2.3.1 Transmitter (Tx)

While Tx is off:
Make sure batteries are installed in Tx, which requires 4 “AA” batteries. Check to see if batteries are either non-rechargeable alkaline, rechargeable nickel-cadmium (NiCd) or nickel-metal hydride (NiMH) cells. However, keep in mind that batteries can’t be mixed
with old and new cells or non-rechargeable alkaline cells with rechargeable NiCd or NiMH cells, etc. AA cell charger is needed if rechargeable cells are used. When installing batteries, check to see if the proper polarities match up to each cell. Make sure Tx is off, when removing and installing batteries. Make sure to replace or recharge batteries, if the Tx LED blinks. This indicates that the batteries are low on power. At all times, do not an RC system model with weak batteries. This could result in reduced range and/or possible loss of control. At all times, do not an RC system model with weak batteries. This could result in reduced range and/or possible loss of control.

Steering:
Make sure that when you turn the steering wheel left and right, it moves accordingly. Make sure there are no obstructions with the steering servo’s movements, and the servo moves in the proper direction.
Steering rate:
Make sure to adjust the dial to your preference to customize control of steering in different applications

Throttle:
Occasionally, squeeze the throttle trigger to make the car move forward.
Range check:
Before operating the model, perform a simple range check to make sure the transmitter maintains radio contact with the receiver within your operating area.

2.3.2 Receiver (Rx)
Check to see if receiver is mounted securely. Avoid having servo wires interfering with any moving parts.

2.4 Steering Servo
Make sure all mechanical linkages are free of obstructions and can move smoothly. When Tx is turned on, then the Tx, make sure all servos operate according to the movement of the Tx control. Regularly inspect gears and servo motors to maintain proper mechanical functionality.

2.5 Electronic Speed Controller
Check occasionally to see if component is defective. If it is, it will be repaired or replaced at no charge. To avoid not being covered by warranty:
Avoid damage from water, moisture, or other foreign material to enter speed control or get onto PC board. Do not use anything other than 6 to 14 cells input voltage. Avoid removing the stock battery connectors. Avoid using the same gender connectors on the speed control’s motor and battery connections. Avoid using cross-connection of the battery and motor(s). Don’t use reverse voltage application or use motor(s) with fewer than 19 turns with molex connectors and 12 turns with Traxxas High-Current Connectors. Minimize or avoid incorrect installing or wiring. Maintain quality of components from
overuse. Always use heat sinks. Don’t remove the capacitors from the stock motor. Avoid splicing to the input wire harness or disassembling the case. Avoid tampering with internal electronics. Don’t expose wiring to short circuit. Most importantly, avoid any damage caused by crash, flooding or act of God.

2.6 Joystick

Avoid power supply that will directly provide 12V to the joystick. Exceeding this voltage may damage the electronics. Avoid water, moisture, or other foreign material from damaging component.

2.7 Wiring

Check to see if all electrical connections remain secure. Regularly check heat shrink and soldering connections. Always make sure the power is off.

3. Technical Description

3.1 Joystick

The joystick implemented on the dashboard of this vehicle is referred to as a two-servo joystick, precisely because it has two sets of wires that can control 2 separate servos. However, in this device, the joystick has the purpose of controlling one servo (steering) and an electronic speed control (ESC) for forward/reverse throttle. Each set of wires that comes from the joystick, consists of three wires – ground (black), power (red), pulse-width modulation (PWM) signal (yellow/white). The set of wires that are soldered to Servo 1 on the PCB of the joystick control the steering servo, while the set of wires that are soldered to Servo 2 on the PCB of the joystick control the ESC.

When the joystick is neutral at center position it sends a PWM signal of 1500 usec to the steering servo as well as the ESC. When the joystick is pushed fully to the right or fully forward it sends a signal of up to 2000 μsec to the steering servo or ESC respectively, causing either the forward wheels to turn about 45-50 degrees to the right or provide the motors in the rear wheels with the full 12 V from the battery supply via the ESC, thus providing maximum speed for the vehicle as it moves forward, respectively. Similarly, when the joystick is pushed fully to the left or fully backward it sends a signal of up to 1000 μsec to the steering servo or ESC respectively, causing either the forward wheels to turn about 45-50 degrees to the left or provide the motors in the rear wheels with the full 12 V from the battery supply with reversed polarity via the ESC, thus allowing the vehicle to reverse at maximum speed for the vehicle, respectively.

If the vehicle is moving forward and the joystick is pulled back, however, rather than moving in reverse, this functions as a braking mechanism, causing the vehicle to stop. Once the vehicle has stopped, the joystick must be released to center and pulled back again in order for the vehicle to reverse.
3.2 *Radio Transmitter/Receiver*

While the joystick remains the primary mode of control, a remote-control mechanism has also been implemented in this vehicle as a secondary mode of control, allowing the parent or guardian to take charge of the vehicle while the child rides. The mechanism is quite similar to the joystick, in that a PWM signal is sent from the receiver to either the steering servo or the ESC, relative to the how the wheel or the trigger on the radio transmitter is controlled. The wheel on the transmitter controls the steering mechanism of the vehicle, whereby turning the wheel forward sends a PWM signal of up to 2000 µsec to the steering servo causing the wheels to turn right by about 45-50 degrees and turning the wheel backwards sends a PWM signal of up to 1000 µsec to the steering servo causing the wheels to turn left by about 45-50 degrees.

Similarly, pushing the trigger forward sends a PWM signal of up to 2000 µsec to the ESC providing the motors in the rear wheels with the full 12 V from the battery supply via the ESC, thus providing maximum speed for the vehicle as it moves forward. And when the trigger is pulled fully backward it sends a signal of up to 1000 µsec to the ESC providing the motors in the rear wheels with the full 12 V from the battery supply with reversed polarity via the ESC, thus allowing the vehicle to reverse at maximum speed for the vehicle. However, if the vehicle is moving forward and the trigger is pulled back, rather than moving in reverse, this functions as a braking mechanism, causing the vehicle to stop. Once the vehicle has stopped, the trigger must be released to neutral and pulled back again in order for the vehicle to reverse.

3.3 *Steering Servo*

The steering servo is what allows automatic steering modification to be implemented for this ATV, as opposed to the manual steering that was previously present. The steering servo was purchased as an assembled top mount servo power gearbox with a 5:1 ratio metal gear allowing for a large amount of torque, which is necessary to turn the wheels of an ATV of this size, especially with the weight of the client added to it. The steering servo was mounted on two aluminum bars that were bolted down to the chassis. A 6” servo arm was connected to the metal gear on the servo gearbox and another metal arm was created and bolted to the first servo arm and to the axle that connects the two front wheels. By using this double-linkage mechanism, the steering servo most efficiently and flexibly turns the front wheels, thereby steering the vehicle.

The steering servo has a potentiometer which facilitates the limits of the gear rotation, thereby preventing a damaging excess in the rotation of the wheels. The potentiometer also maintains the neutrality of the front wheels in accordance with the joystick and radio transmitter/receiver. Furthermore, the steering servo has a set of ground-power-PWM wires with a male connector that can be plugged into the female connector of the joystick wires or into the radio receiver. From either of these controls, the servo will receive the required power as well as the aforementioned PWM signals. The relationship between the PWM signal and the rotation of the servo arm via the servo gear is displayed in the fig. 16. It is good to note here the speed of the rotation: according to the specifications for this
particular 5:1 servo gearbox we have implemented, the rotation speed is about 0.72 seconds/60 degrees rotation. Also the maximum torque supplied by the 5:1 servo gearbox when receiving 6V is 1,715 ounce-inch.

**Figure 16. Degrees of rotation of steering servo in relation to the PWM signal received**

### 3.4 Electronic Speed Control (ESC)

The ESC is the most crucial component of the ATV. Firstly, it controls the throttle of the vehicle. As discussed in sections 3.1 and 3.2, the ESC receives a PWM signal from either the joystick or the receiver which accordingly allows it to provide the respective voltage and polarity to the two motors in the rear wheels as mentioned previously.

Furthermore, the ESC is the “channel” through which the necessary power from the 12V battery power supply passes to the entire ATV system, adequately powering all components without any extra battery packs or power supplies. The ESC that was used comes with terminals for 2 separate battery packs. However, since only one big 12V battery supply was being used to power the vehicle, a jumper was created for one of the battery connector terminals of the ESC, while the 12V battery supply was connected to the other terminal of the ESC. A jumper is simply a wire that connects the positive and negative terminals of the power supply connector, thereby closing the circuit and allowing the power to flow through the entire network without any problems. The 12V from the battery power supply is then transmitted to the motors as necessary, depending on the PWM signals received.

The ESC has a built-in battery eliminator circuit (BEC) which receives the 12V from the battery supply and eliminates 6V, supplying only those 6V to the rest of the system, excluding the motors. This is very beneficial as all the other components – the receiver, the joystick, the steering servo – can all take up to 6V, thus eliminating the need for multiple separate battery packs to power each of the different components.

Furthermore, an adapter was made for the ESC connector to the battery power supply since the original connector was not compatible with the battery connector. This was done by cutting the connector from the battery charger and soldering it to the connector terminals for the power supply connector. A new battery charger was purchased to
replace the old one. A note must be made that once the battery power supply is connected to the ESC, the power button on the ESC must be pressed until the green LED light is seen in order for the ATV to function.

3.5 Y-harness

A Y-harness is a servo-wire extension, displayed in fig. 17, with a male connector on one end and two female connectors on the branched ends. Such a connector would allow for a signal from one component to be passed simultaneously to two other components. Although, such a Y-harness is what was needed to send the power supply from the ESC to the radio receiver as well as the joystick (as discussed in section 3.4), one complication arose. The servo wire coming from the ESC has a male connector, while the connector for the joystick and receiver are females. This causes a problem in connecting the components, since like connectors don’t connect (a male connector connects with a female, NOT another male, and vice versa). Interestingly enough, there are NO Y-harnesses on the market that are reversed, as was necessary. Therefore, a Y-harness was custom-designed for the purpose mentioned, displayed in fig. 18.

![Figure 17. Y-harness found on market](image1)

![Figure 18. Y-harness created](image2)

A pre-existing Y-harness was taken and the connectors were cut and replaced with two male connectors on the branched ends and a female connector. This was done by cutting the connectors, stripping the tips of the wires, soldering together the stripped wire tips of the needed connectors to the respective ends and using a heat shrink tube to conceal the soldered location. Plastic wire conduits were used to hold together the wires of each branch of the Y-harness. A note must be made that only the ground (black) and power (red) wires were connected in such a manner. The PWM signal wires (yellow/white) were left stripped for a reason that is discussed in the following section.
3.6 Single-Pole Double-Throw (SPDT) Switches

Another crucial aspect of this modified ATV is the easy feature of switching modes of control as needed by the user. This feature involves using SPDT switches, which essentially closes a certain “circuit A,” while leaving a certain “circuit B” open. And when the switch is flipped, circuit B closes while circuit A remains open. A diagram of an SPDT switch mechanism is shown in fig. 19, and an image of an SPDT switch that was used is shown in fig. 20.

![SPDT switch mechanism](image19.png)  ![SPDT switch used](image20.png)

Figure 19. SPDT switch mechanism  Figure 20. SPDT switch used

Two of such SPDT switches were used to provide the user an easy way of changing the mode of operation from Joystick to Remote-Control. Firstly, servo extension wires, shown in fig. 21, were purchased so as to not cut any of the wires directly connected to the components in case of any future issues where any of the components might need to be replaced or exchanged. Making modifications to a component directly voids the warranty on that component.

![Servo extension wire](image21.png)

Figure 21. Servo extension wire

Once these servo extension wires were connected between the steering servo and the joystick/radio-receiver in order to transmit the power to the steering servo as well, the PWM wire was cut and the ends were stripped. The stripped ends of the PWM wire coming from the joystick and receiver were connected to the pins on either end of the SPDT switch, while the stripped end of the wire going to the steering servo was connected to the middle pin of the SPDT switch. This would allow the user to switch the
source of the PWM signal to the steering servo from either the joystick or the receiver, thereby changing the mode of control for the steering servo.

Similarly, going back to the Y-harness that was created (discussed in section 3.5), the PWM wires that remained stripped at the ends and unconnected were connected to a second SPDT switch. Just as for the steering servo, the stripped ends of the PWM wires coming from the joystick and receiver were connected to the end pins of the SPDT switch, while the stripped end of the PWM wire going to the ESC was connected to the center pin of the SPDT switch. This would allow the user to switch the source of the PWM signal to the ESC from either the joystick or the receiver, thereby changing the mode of control for the ESC.

These switches along with the joystick were mounted on a center console or dashboard that was manufactured using a sheet of aluminum, bent and cut as needed and mounted on the top of the front portion of the ATV. Labels are posted to indicate which direction the switches should point to for the needed mode of control. It must be noted that when the switches are in the center position, no PWM signal is being passed through to either the steering servo or the ESC and therefore neither mode of control will function when the switch is in center position. Caution should be taken to make sure that both switches are oriented in the same direction, so as to have the same mode of control for the steering AND throttle.

3.7 Wiring Network Map for Components

The wiring network map for all the components discussed above is shown below in fig. 22.

![Wiring Network Map for all Components](image)

Figure 22. Wiring Network Map for all Components
4. Troubleshooting

4.1 Remote Control System

4.1.1 Receiver (Rx)

If range is short: Interference
   1) Check Rx installation and servo connections.

If there is a Low Transmitter (Tx) or Rx battery
   1) Replace the batteries

If there is crash damage:
   1) Send the radio to Hobby Services for repair.

If run time is short: Low Tx or Rx batteries
   1) Replace the batteries.

Obstructed servo linkages causing excess battery drain
   1) Free the linkages / pushrods.

If Tx LED is on, but servos do not function: Rx batteries are low
   1) Replace the batteries.

If Rx switch is in the off position
   1) Turn on the ESC or switch harness.

If switch harness or ESC is connected incorrectly
   1) Check all connections and the ESC instruction manual.

If Rx is not binded to the Tx properly
   1) Perform binding process again.

If there is interference or servos glitching: Out of range
   1) Operate the model more closely to the transmitter.

Outside radio interference (pagers, strong industrial or other commercial transmitters in the area)
   1) Check your local R/C club for confirmation of dangerous / interfering frequencies in your area.

If there is only one servo glitches: Servo is bad
   1) Replace the servo or send to Hobby Services for repair.
**4.1.2 Tx**

If the Tx LED blinks,
1) Make sure to replace or recharge batteries,
2) This indicates that the batteries are low on power.

If “Power” LED light isn’t turned on
1) Check batteries.

Steering:
If the wheel is turned to the right but the model turns left
1) Reverse the position of the steering reversing switch.

Throttle:
If the car moves backwards
1) Reverse the position of the throttle-reversing switch.

**4.2 ESC**

If steering channel works, but the motor(s) will not run:
1) The motor(s) could be bad or have a damaged brush. Check the motor(s) and motor connections by supplying power directly to the motor(s). Note: Disconnect the motor(s) from the ESC before testing. Remove the pinion gear from the motor(s) or elevate the driving wheels to avoid a runaway and damage to the vehicle.
2) The ESC has thermally shut down (look for a solid green LED). Allow the ESC to cool down. Read overheating section.
3) Make sure the EVX-2’s power cable is plugged into the throttle channel of the receiver. Check the operation of the radio system’s throttle channel with a servo.
4) Possible internal damage. Return the EVX-2 to Traxxas for service.

If motor and steering servo do not work:
1) Check the wires, RC system, crystals, battery and motor connectors, and the battery packs.
2) Possible internal damage. Return the EVX-2 to Traxxas for service.

If EVX-2 will not go into programming mode:
1) Make sure EVX-2 is plugged into the throttle channel on the Rx. If it is plugged into another channel or the battery terminal, it will not go into programming mode
2) Be sure the EVX-2 is turned off before trying to program or select a profile.
3) Unplug battery, reconnect, and repeat programming instructions.

If motor(s) run backwards:
1) Motor(s) wired backwards: check the wiring and correct
2) Backwards motor timing: reverse the motor end bells.

If Rx glitches/throttle stutters during acceleration:
1) Motor capacitors broken or missing: check and replace the capacitors.
2) The Rx or antenna is too close to power wires or batteries.
3) Bad connections: check the wiring and connectors
4) Motor worn: replace the motor
5) Excessive current to the motor: use a milder motor or a smaller pinion gear.

If model runs slowly or has a slow acceleration:
1) Check the motor and battery connectors
2) Check to see if EVX-2 is in Profile #3 (50% throttle)
3) Bad battery or motor: check the operation with known good batteries, meaning a freshly charged one and motor
4) Incorrect Tx or speed control adjustment. Reprogram the EVX-2
5) Motor is improperly geared: use a milder motor or a smaller pinion gear
6) Check the drive train for binding or restrictions

If EVX-2 overheats and shuts down:
1) Overloading the motor (running through tall grass, binding in the drive train)
2) Insufficient ventilation for the heat sinks. Cut ventilation holes in the body or relocate the EVX-2
3) Motor may exceed maximum specification. The EVX-2 is limited to motors with no fewer than 19 turns (550 size) with molex connectors and 12 turns (550 size) with Traxxas High Current Connectors
4) Motor is improperly geared. Use a milder motor or a smaller pinion gear
5) Check the drive train for restrictions

4.3 Joystick

If you notice that your servos are jittering or do not have much power
1) The power supply is not producing enough amperage

If you are not using a power supply, but a regular hobby Rx battery pack
1) Y-harness needed

4.4 ATV

If the vehicle does not operate
1) Check that all the plugs are properly connected
2) Check electrical switches. Replace if necessary
3) Check that the battery is connected to the electrical system

If there is no power
1) Fully recharge the batteries

If there is still no power after fully recharging
1) Check with an Authorized PEG PEREGO Service Center

4.5 Battery

If a leak develops
1) Shield your eyes
2) Avoid direct contact with the electrolyte and protect your hands
3) Place battery in a plastic bag and follow procedures for disposing batteries