SwimView

A Remote-Controlled Camera System for the Kinesiology Department at Auburn University

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Table of Contents

Assembly

Track and Cable Tray

1. Connect track sections end to end for desired length of track.
2. The large aluminum endcaps go at the ends of the track. To fit them, remove the brass cap at the end of the track with a screwdriver. Slide the endcaps into the track.
3. Attach the provided U-bolts to every other cross piece 3 inches away from the outside rail. **If possible, leave U-bolts attached to track at all times for quicker assembly and disassembly each use.**
4. Unroll the cable tray to ensure the tray rolls out correctly (tray may need to be rotated if knots,loops, or twists are formed).
5. Lay the power cord and cable tray inside the U-bolts and outside rail. The power cord should be on the first half of the track, while the cable tray is made for the second half.
6. Attach the end of the cable tray to the middle of the track with the provided clip.
7. **Before attaching the cable tray to the box, attach the camera arm.** See the *Box Power* section for more details on attaching the cable tray to the box.

Camera Arm

Note: Camera arm assembly is much easier if done before the box is placed on track and still on the large gray wheels.

1. Remove the white cap on the top of the camera arm.
2. Slide the camera arm through the mount to the desired length.
3. Hold the arm in place by tightening the lock in place on the side of the mount (Ensure the camera is pointing 90° away from the pool wall).
4. Feed the wires through the white cap and then tighten the white cap back in place (This is safety feature to stop the camera from sinking if the arm becomes loose). Be careful not to yank the wires; do not pull on the wires when detaching.
5. Attach the two connections to the wires attached to the extended arm mount.

Pulley System

1. Box must be placed on track rails before pulley assembly can begin.
2. Feed the paracord into the box from the slit in the bottom. Wrap the paracord around the pulley twice, and ensure that it covers the circumference of it fully.
3. Feed the paracord through the loops on the bottom of the box.
4. Attach the cord to the fasteners on the end caps at each end.

5. Wrap the rubber cable around the motor and the pulley driver. Make sure that the cable is sufficiently taut around the motor and pulley driver.

Box Power

1. To turn on the box, hook up the 120V cable from the cable tray to the box to provide AC Power. Folding the cable tray back may be necessary.
2. When the connection from the tray is made, the cable tray needs to be secured to the L piece on the side of box by sliding the cable tray over the piece.
3. Tighten the tray down by securing the two U-bolts into place.
4. Inside the box, flip the largest switch to the ON position to turn on the 24V AC-to-DC power converters.
5. Ensure the the three vertical LEDs to the right of the switch illuminate. (The top LED indicates power to the camera. The two LEDs below it indicate power to the power converters.)
6. The power converters also have green LEDs on them. If one fails, the LED will not be showing green at that converter.
7. Flip the three smaller switches to the ON (|) position. Starting at the main power switch, the three smaller switches represent 12V, 5V, and 5V, respectively.
8. Ensure that the three blue LEDs are illuminated.
9. Ensure that the red kill switches on the outside of the box are not pressed. (To unlock, twist the switch.)

Video

1. Ensure the USB drive is plugged into the HD Video Capture box located on the top shelf.
2. LED on the side of the box should be illuminated green to indicate that the system is ready to record.
3. Ensure the monitor is plugged in and turned on.
4. Ensure the wireless video receiver is plugged in and turned on.

Operation

Remote Control

To begin, sync the XBOX controller by holding down the center XBOX button until the green lights begin to flash. When connection is made, the top left (Player 1) indicator light will turn on. The bottom right joystick on the XBOX controller controls the speed of the motor. Only the left and right functionality of the joystick are used, the up and down are not. Holding the joystick all the way to the right or left accelerates the motor to top speed. Releasing the joystick will cause the motor to continue at constant speed in the same direction. To stop the motor, press the "A" button on the XBOX controller.

Accessing Stored Video Files

A hard drive for high definition recording is inside of the box. The "B" button on the controller starts and stops the recording. Each time a recording is started and stopped, it will create a new file. An indicator LED on the box will be green when the recording system is on standby and waiting to be started. After the B button is pressed and the LED changes to red (recording) allow at least 2 seconds to ensure the entire swim is captured on video file. When recording is stopped by pressing "B", the LED will flash red and green before returning to green. To access the files, remove the USB storage drive from the box and plug into a computer.

Maintenance

Cable Tray

If cable tray snaps, it should be easy to pop it back into place. Removing one broken link may solve the problem as long as the tray maintains enough distance for half the track. If more pieces are needed, refer to parts list #2 to reorder the part.

Track End Caps

If the one of the end caps break, it may need to be refabricated. Refer to the TES Lab Tech John Tennant in Broun Hall if necessary.

Power Supply

The power supply refers to the two identical power converters mounted side by side on the side of box. If one breaks refer to parts list # 20 to reorder the part.

Control Panel

The control panel is mounted underneath the shelf. If problems arise with the control panel, check the blue LED indicators to help during troubleshoot. Refer to the Box Power section under Operations to understand each indicator.

Motor

Always monitor the condition of the motor. If the motor is defective, refer to parts list #18 to reorder.

Pulley

The pulley is turned by the motor. Always make sure the cable driver and pulley are locked down to the shaft on the pillow blocks. Use a hex head screw driver to tighten. If the pulley breaks refer to to parts list #7 to reorder.

Sensors

There are 7 sensors on the box.

1. Two Emergency Stop buttons. These are located on the front and back of the box. If one is loose or falls off, screw it back on with Phillips screwdriver. As you tighten the screw, the button will tighten on each end of the hole. If the button is defective, refer to parts list # 16. The new buttons may need to be soldered to the existing wires.
2. There are four active proximity switches. They are located at the bottom of the box, where the cable guides are. The proximity switches have a limit range that can sense the presence of a magnetic field. If a proximity sensor is defective, you may need to strip the

connection at the 9 pin block on the control panel. Refer to parts list # 57 to reorder the part. The new sensor will need to be stripped and soldered to the 9 pin block.

3. There is one proximity sensor for the door. If the motor isn't working, it is best to test this sensor first while trouble shooting. If the sensor is not picking up the magnet located at the top of the door, it will override the four proximity sensors and deactivate the motor. If this proximity sensor is defective, you may need to strip the connection at the 9 pin block on the control panel. Refer to parts list # 57 to reorder the part. The new sensor will need to be stripped and soldered to the 9 pin block.
4. For stripping and soldering, the TES Lab Tech John Tennant in Broun Hall may provide assistance.

Camera Arm

Wireless Video Streaming

If the wireless video feed is not being seen on the monitor, make sure the yellow RCA cable is plugged into the Nyrius video transmitter inside the box and from the Nyrius video receiver to the monitor. The video transmitter can be located underneath the shelf inside the box.

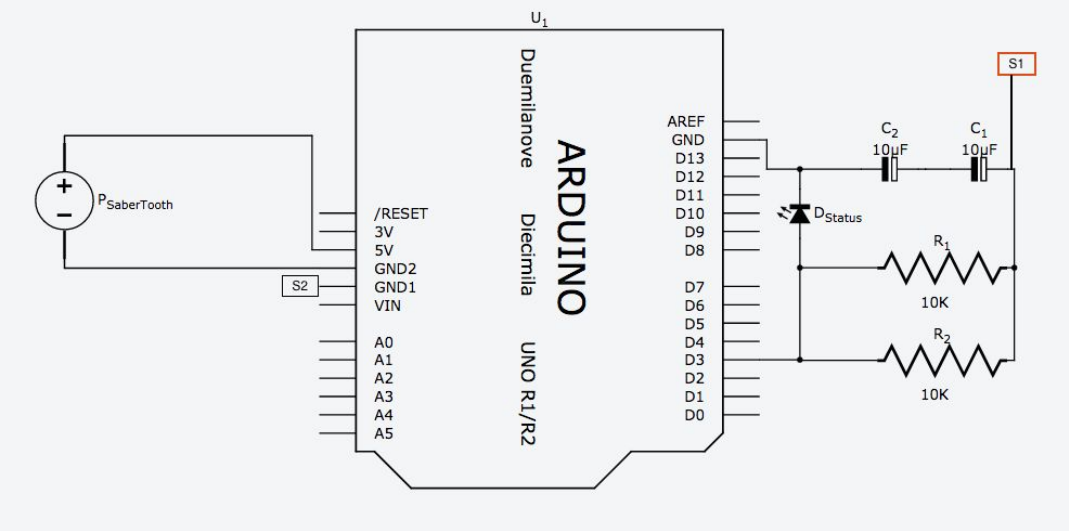
The 12V switch is for providing power to the motor, camera, video transmitter. When it is on, the blue LED below it is on. The 5V switch is for providing power to the Arduino microcontroller, SDI-to-HDMI converter, and video capture card.

Video Storage

Ensure the HD Video Capture Card on the top shelf of the box has a USB storage device plugged in. Troubleshooting the capture card by physically pressing the record button on the unit will provide feedback. If recording works by pressing the button, the problem may be in the connection of the XBOX controller to its receiver. If a problem persists, the USB storage may be full.

Arduino Microcontroller

The Arduino controls the interaction between the Xbox controller and the Sabertooth driver. If there is a problem with either the Arduino itself or the USB shield attached to it, the Arduino and Keyes USB Host Shield can be replaced at very low cost using Amazon. The Arduino is programmed using the attached USB cable, and should be loaded with the program found at https://github.com/swimview/arduino/. The arduino output is designed to be driven across a small low-pass filter as seen in the diagram below.

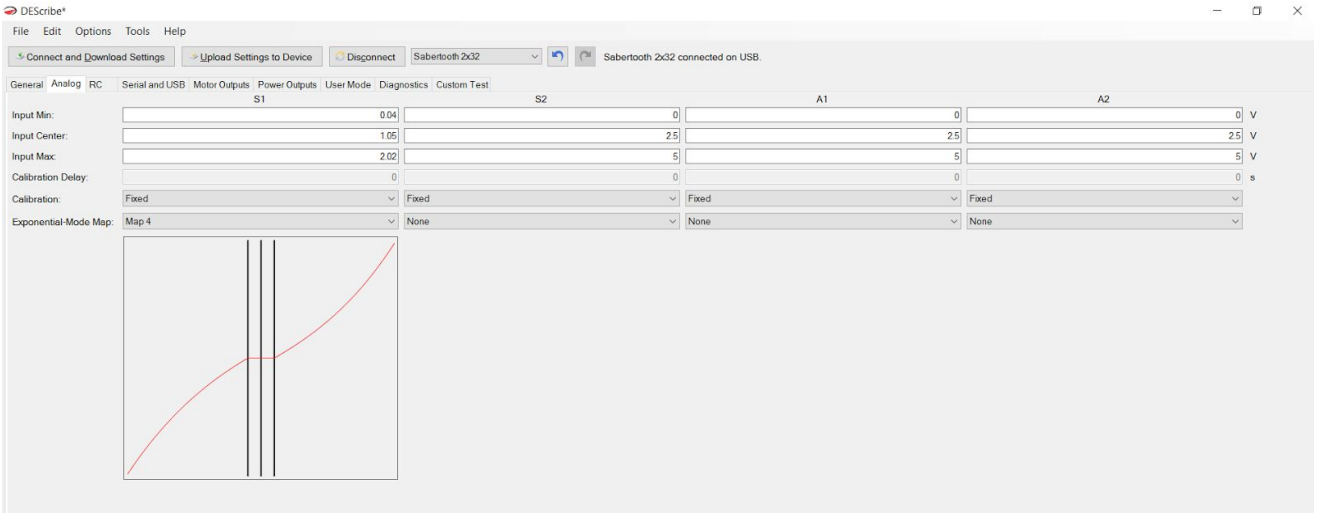


Sabertooth Motor Controller

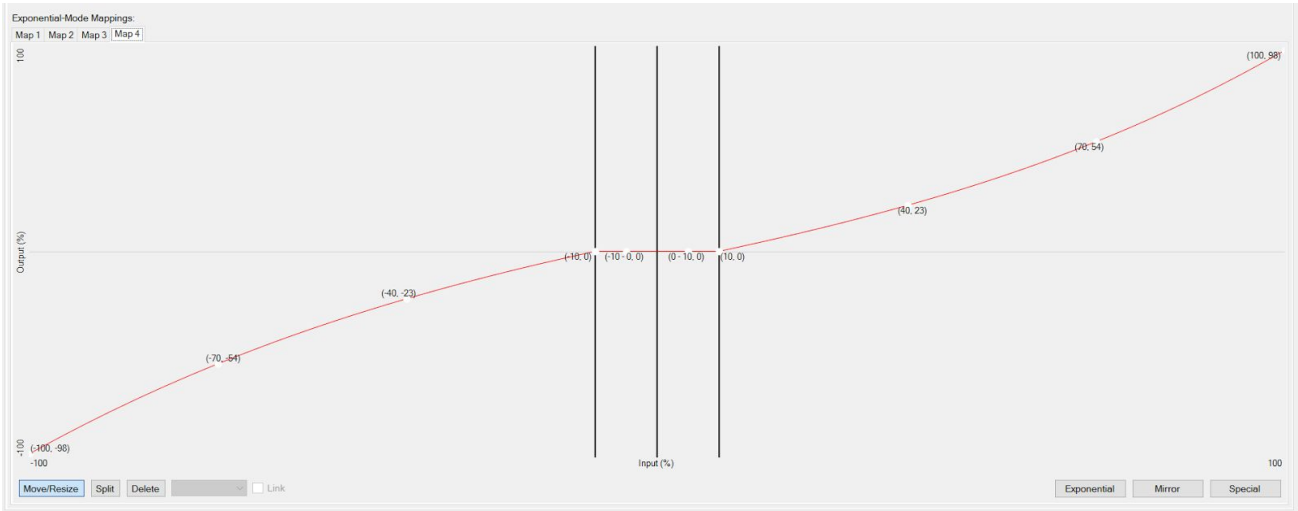
In the event that the Sabertooth Motor Controller must be reprogrammed (if malfunction or replacement occurs):

1. The dip switches on the Sabertooth Motor Controller must be set to the correct values. From switch 1 to switch 6: On, On, On, Off, On, On.
2. The controller must be programmed to accept the correct values for motor input and to have a deadspace about the center of input. These can be programmed by downloading the Dimension Engineering DEScribe PC software, available at https://www.dimensionengineering.com/products/sabertooth2x32.
3. After downloading and installing the DEScribe PC software, connect the Sabertooth to a USB port on the computer using a micro USB to USB connector. https://github.com/swimview/arduino
4. Start up the DEScribe software; when prompted, choose to “Connect and Download settings” to connect to the Sabertooth. The program should auto-detect the Sabertooth device; if it has trouble finding the device, try a different port.
5. Download the settings file, SwimView_SabertoothSettings.tooth, from the GitHub at
6. Click on File>Open>SwimView_SabertoothSetting.tooth. Continue to Step 7.

7. If for some reason the provided files are unavailable, all settings can be input manually.
    a. Click on the Analog tab. Look at the column of values under S1:



    b. Input Min should be set to 0.04. Input Center should be set to 1.05. Input Max should be set to 2.02. Calibration should be left as Fixed. Exponential-Mode Map should be set to Map 4 (arbitrary map number).
    c. Go back to the General tab. There is a subsection with Map tabs; go to Map 4 (or whichever one you chose). Click on the button "Exponential" in the bottom right hand corner (this generates an exponential map if there isn't one already).
    d. Use the "Split" button in the bottom right hand corner to add 2 additional sections. Place these sections at -10% and 10% on the x-axis (Input %). Set these sections to constant by clicking on the section, clicking the "Curve" drop-down box in the bottom left of the screen, and changing it to "Constant". Then drag the line in this section to 0% on the y-axis (Output %).



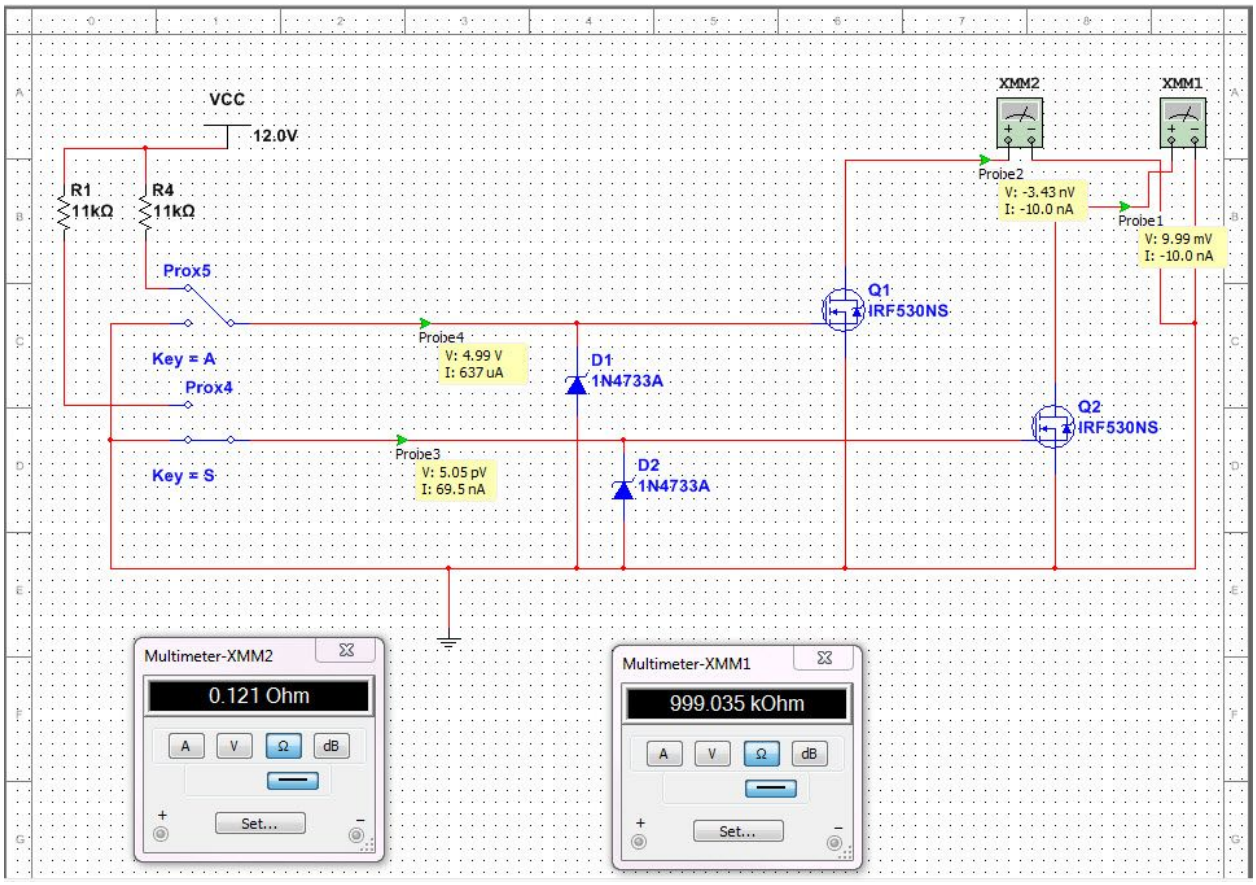
8. Click “Upload Settings to Device” and then click “Disconnect” before exiting.
9. Sabertooth inputs (B-, B+) and outputs (M1A, M1B) should be attached to the new Sabertooth in the same fashion as the old: input power from the control unit’s left side, output power to the control unit’s right side (as seen when facing the open box; output power from sabertooth goes to the pair of power connectors on the right side; the other power connector connects to the motor).
10. Sabertooth connections on the other end of the Sabertooth (0V, 5V, S1, S2) should be connected to the microcontroller. 0V and 5V output to the microcontroller’s corresponding inputs; S1 receives signal from the output of the low-pass filter, S2 is connected to a ground from one of the microcontroller’s ground outputs (see Section *Arduino Microcontroller* for more details).
11. For other inquiries, exploration of the various manuals on the product page may be necessary. https://www.dimensionengineering.com/products/sabertooth2x32

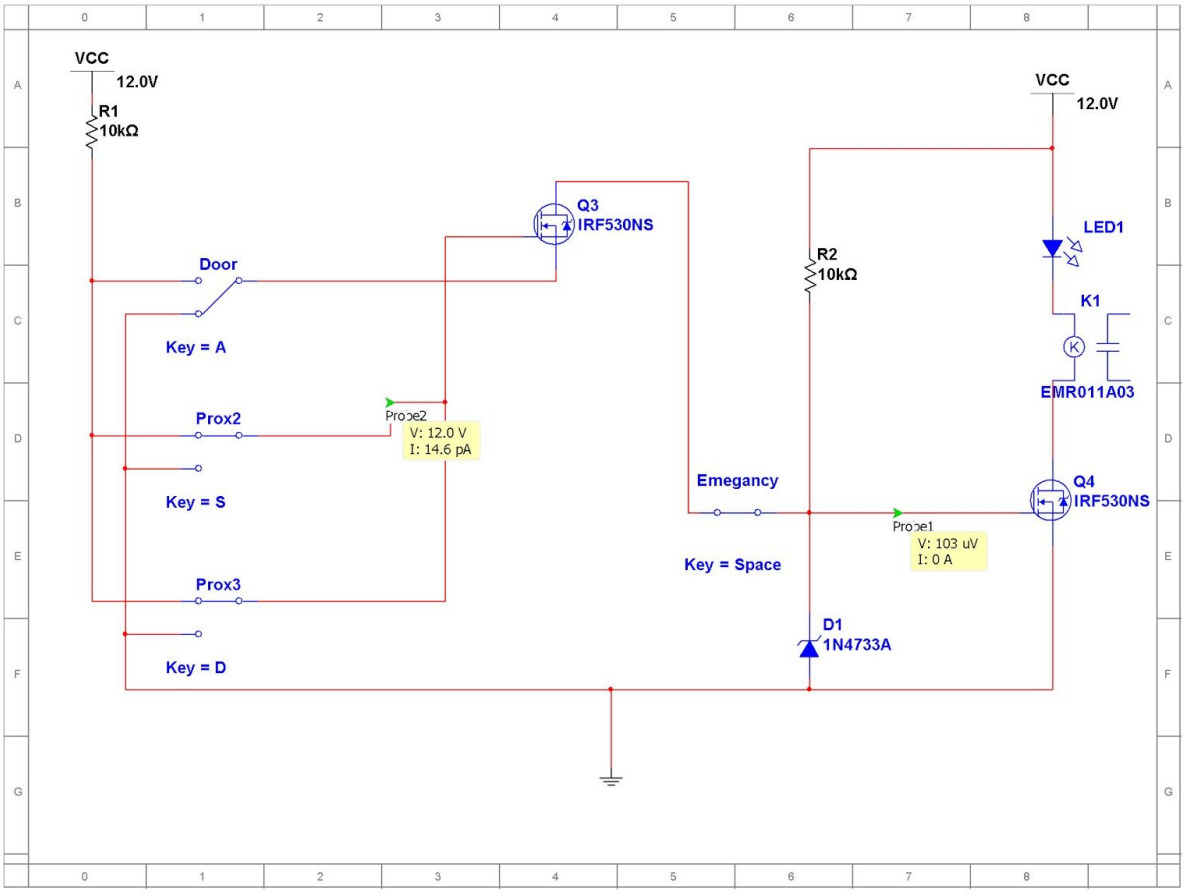
Parts List

1. 1/8” thick 5052 Aluminum Sheet 24”x 48”
2. 15mm x 30mm black plastic semi closed drag chain cable carrier x13
3. 18-8 Stainless Steel Nylon-Insert Flange Locknut, 1/4”-20 Thread Size
4. 18-8 Stainless Steel Round Head Phillips machine Screw ¼”-20 thread, 1” Length
5. 18-8 Stainless Steel socket head cap screw 1/4”-20 in the morning thread, 4” length
6. 2 pole 5mm pitch PCB mount Screws
7. 2.17" 3L-Size Pulley with hub-3/4" bore
8. 3/16 inch Key Stock - 12 inches long
9. 3/4 inch bore UCP Pillow Block
10. 3/4 inch bore Zinc Plated Shaft Collar
11. 3/4 inch diameter keyed shaft (In Inches)
12. 316 Stainless Steel turnbuckle clevis to Eye x2
13. 316 Stainless Steel Washer for ¼” Screw Size, .281” ID, .625” OD
14. 3L1150 V-Belt
15. 4.17" 3L-Size Pulley with hub-3/4" bore
16. 5 NJK-5002c Hall Effect sensors Proximity Switch NPN
17. AGPtek HD Game Capture HD video capture 1080P Recorder
18. AmpFlow E30-400 Motor with Speed Reducer
19. Ampflow Mount 1/2 inch thick - with heatsink (1 mount)
20. DROK waterproof synchronous DC-DC converter 5.5-32Vx3
21. Eyoyo 8” TFT LCD HD Monitor color Screen
22. Glide Gear Dolly Track Swivel Wheel Assembly
23. Jam Nut for 316 SS Turnbuckle x 2 LH THRD
24. Jam Nut for 316 SS Turnbuckle x 2 RH THRD
25. Kangaroo x2 motion controller
26. Low-Pressure Type 304 SS Cast Flange Threaded x2
27. Marshall Electronics CV200-MB, 2.1 Megapixel Lipstick POV Camera
28. Multipurpose 6061 aluminum ½” thick x 4” width x in the morning 6’ length
29. Multipurpose 6061 Aluminum 90 Degree 1/4” thick L Bracket
30. Multipurpose 6061 Aluminum 90 Degree 1/8” thick L Bracket
31. Multipurpose 6061 Aluminum Rod 1-1/2” Diameter, 1’ in the morning length x4
32. Nite Ize CamJam aluminum rope and cord Tightener
33. Nylon-Insert cap Locknuts ¼”-20 Thrd Sz, Packs of in the morning 25
34. OSOYOO 3.5 Inch Screen
35. Nyrius 5.8GHz 4 Channel Wireless Video and Audio Sender Transmitter and Receiver
36. Sabertooth 2 x 32 Dual Motor Speed Controller
37. Sandisk

38. Thick Wall 316/316L SS Threaded Pipe ½ diameter 3’
39. Thick Wall 316/316L SS threaded pipe 2’
40. Thick wall 316/316L SS threaded pipe 3’
41. Topeakmart 24” Truck Tool Box Aluminum
42. Tough Grid 750LB Black Paracord
43. Type 18-8 Stainless Flange nut 3/8” x4
44. Type 304 Stainless fitting 1 pipe size locknut x4
45. Type 304 Stainless fitting 1-1/4 Male x 1 female
46. Type 304 Stainless fitting 1-1/4 pipe size locknut
47. Type 304 Stainless threaded pipe fitting 1-1/4
48. Type 316 Stainless hex head cap screw 3/8” x4
49. US Wire 74100 12/3 100’ Heavy Duty Extension Cord
50. USB adapter
51. Uxcell AC110V/22V to DC24V 25A 600W Switch Power x2
52. V-Belt Pulley, ¾” fixed, 10.98”OD, Zamak3
53. Vibration Damping u-bolt 316 SS
54. Wiistar mini HD 1080P 3G SDI to HDMI Converter
55. X-box wireless controller
56. Yosoo Hanging Buckle Spring Backpack clasps
57. Omron E2B Proximity Sensor


Voltage adjustment screw
DROK
DC/DC 5A MAX
3005ADJ
IN-R
5.5-32V
OUT-Y
1-27V


VCC
12.0V
R1
11kΩ
R4
11kΩ
Prox5
Key = A
Prox4
Key = S
Probe4
V: 4.99 V
I: 637 uA
Probe3
V: 5.05 pV
I: 69.5 nA
D1
1N4733A
D2
1N4733A
Q1
IRF530NS
Q2
IRF530NS
XMM2
XMM1
Probe2
V: -3.43 nV
I: -10.0 nA
Probe1
V: 9.99 mV
I: -10.0 nA
Multimeter-XMM2
0.121 Ohm
A
V
Ω
dB
Set...
Multimeter-XMM1
999.035 kOhm
A
V
Ω
dB
Set...


VCC
12.0V
R1
10kΩ
Door
Key = A
Prox2
Key = S
Prox3
Key = D
Probe2
V: 12.0 V
I: 14.6 pA
Q3
IRF530NS
Emegancy
Key = Space
R2
10kΩ
D1
1N4733A
VCC
12.0V
LED1
K1
EMR011A03
Q4
IRF530NS
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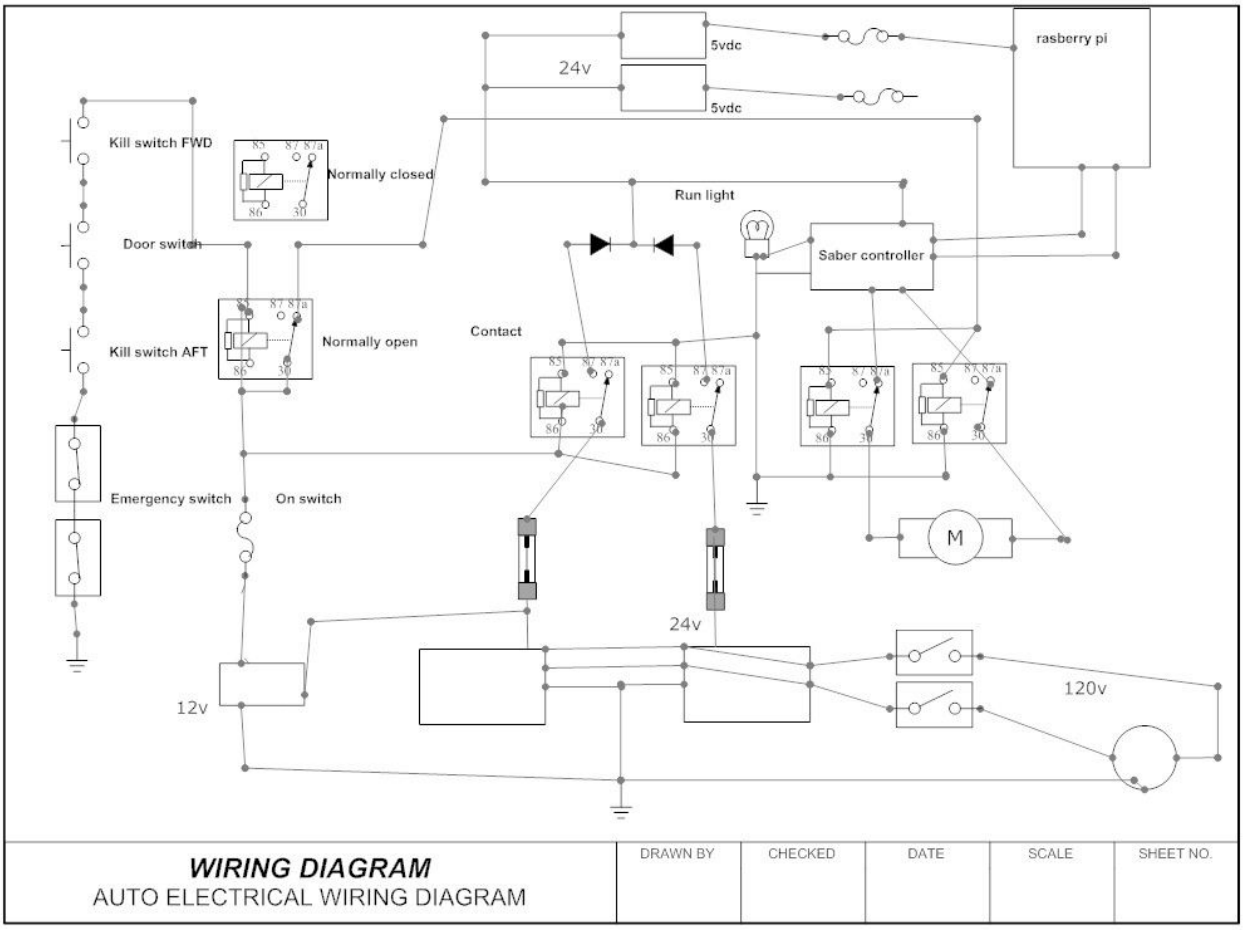
I: 0 A


24v
5vdc
5vdc
rasberry pi
Kill switch FWD
Normally closed
Run light
Door switch
Saber controller
Kill switch AFT
Normally open
Contact
Emergency switch
On switch
M
24v
12v
120v
WIRING DIAGRAM
AUTO ELECTRICAL WIRING DIAGRAM
DRAWN BY
CHECKED
DATE
SCALE
SHEET NO.