IMPORTANT SAFETY INSTRUCTIONS

THE DON’TS AND DO’S OF THE CLASSIC ROCKER:

- DON’T jump into or on the chair.
- DON’T put music so loud as to distort sound, break speakers, or otherwise injure user’s eardrums.
- DON’T cover over any areas that have air holes drilled (power supply, switching port box), as the air holes are used to dissipate heat from the devices.
- DON’T sit on chair when back in folded down. The Speaker Box is embedded in the top of the chair and may be damaged if weight is applied to it.
- DON’T stick hands in or near moving parts or the enclosed areas while chair is operating.
- DON’T pick at, gnaw on, or otherwise play with any wiring.
- DON’T operate in an environment below 20°F or above 120°F.
- DON’T operate near or rest into standing water.

- DO use the chair as directed in the instructions.
- DO have fun and use the chair within reason.
PARTS AND ACCESSORIES

Before operating, please familiarize yourself with the Classic Rocker and its major parts (refer to diagrams on Pages 4, 5 and 6):

- **Chair (Page 4)**
  - Linens ‘n’ Things Folding Video Rocker
    - Seats the user during device operation.

- **Motor (Page 5)**
  - Dayton 1Z831 Gearmotor
    - Moves the cam system and pushes the linkage bar in an elliptical motion.

- **Caretaker Control Tower (Page 4)**
  - CD Receiver (Page 6)
    - Boss® Audio CD-3020 In-Dash CD Receiver
      - Receives radio signals and plays CDs for the audio components of the chair.
  - Switching Box (Page 4; Page 5 for close-up)
    - OKW enclosure
      - Houses MASTER POWER, MOTOR POWER switches, MOTOR and AUDIO circuit breakers, and dial for ROCKING SPEED.
  - Interchangeable Port/Motor Controller (IP/MC) Box (Page 5)
    - OKW enclosure
      - Houses circuit board for motor controller and ports for AUDIO and MOTOR user switches to be attached to.

- **Antenna (not visible) (Page 4 for position)**
  - Receives radio signals for CD Receiver.

- **Speaker box (not visible) (Page 4 for position)**
  - MA Audio® HK-35 Full-Range Speakers
  - PVC sheeting
    - Houses speakers in top of chair. Plays music for user to listen to.

- **User Control Tower (Page 4)**
  - User Switches (Squish Switch and Touch Switch)

- **Power Supply (Page 4)**
  - Mean Well S-240 240-Watt Power Supply

- **Hinging/Linkage Devices (Page 4)**

- **Orange Power Cord (Page 4)**

- **Frame (Page 4)**
  - 80/20, Inc. Aluminum Extrusions

- **End Caps/Extrusion Covers (Page 4)**
  - 80/20, Inc. Aluminum Extrusions
Figure 2: IP/MC Overview

Figure 3: Switch Ports

Figure 4: Switching box Overview

Figure 5: Rocking Speed Overview
Figure 6: CD Receiver Overview
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1.) INTRODUCTION

1.1) GENERAL DEVICE OVERVIEW

The device begins with a Linens ‘n’ Things Folding Video Rocker, which can be seen below. The chair sits directly on the floor and has a curved lower bottom in order to allow rocking. The frame doubles as the runners of the chair.

The chair has a frame attached to it that is made of 80/20 Inc. aluminum extrusion pieces in order to take most of the forces of rocking instead of pushing and pulling directly on the chair. The frame is held together with specific corner brackets from 80/20 Inc. and specialized screws and T-nuts that are vibration-proof. The screws require US Allen wrenches to fix them into place. The frame can be seen on the following page.

Figure 7: Linens ‘n’ Things Folding Video Rocker.

Classic Rocker Operator’s Manual
PAGE 8
The internal frame rests on two hinges that were machined specifically for the overall device. They allow the chair to pivot about one central point instead of rocking over all of the surface areas of the runners. The hinges can be seen below.

Figure 8: Internal frame of chair

Figure 9: Hinging device
The hinges are attached to the main frame of the device, which can be seen below. The external frame is also made of 80/20 extrusions, and is strong enough to withstand any forces applied to it by the motor. In a similar fashion, corner brackets, special screws and T-Nuts hold the frame together.

Figure 10: External frame

Attached to the external frame are the caretaker and user control towers. The caretaker control tower houses the CD Receiver, the IP/MC box, and the switching box. The user tower holds the squish and touch switch for the devices. The two towers are located on the rear right of the overall device, and both can be seen on the following page. They are also connected to the frame via corner brackets and screws from 80/20 Inc.
The caretaker control tower allows power to flow through the audio and motor components via simple switches, as well as controls the rocking speed with the use of a potentiometer with a knob attached, which acts as a dial. In addition, the CD Receiver, a Boss® Audio CD-3020 In-Dash CD Receiver is housed in here. It is controlled directly on the face. It plays CDs and also receives radio signals. The caretaker tower also houses two circuit breakers for both the audio and motor components, as well as the switching ports of the device. The top of the caretaker tower can be seen below.
Inside the IP/MC box sits both the switching ports and the motor controller circuit board, which can be seen below. Some of the output from the power supply goes into the controller and then passes to the potentiometer, which acts as a speed controller. The output of the potentiometer then passes to the motor in order to limit the amount of amperage that passes to it. The motor controller and switching ports can be seen below.

![Motor controller circuit board and switching ports](image)

**Figures 14 & 15:** Motor controller circuit board and switching ports

At the bottom of the caretaker control tower sits the power supply. The supply (Mean-Well S-240-12) provides power to both the CD Receiver and Motor. In the photo, the power supply is encased in Plexi-Glass in order to offer the operator a better idea as to the position of the supply on the device. However, on the final product it is encased in plastic PVC sheeting in order to beautify the prototype. A picture of the supply can be seen below.

![Mean-Well power supply](image)

**Figure 16:** Mean-Well power supply
Connected to the power supply is a modified extension cord that acts as the power cord of the device. The cord can be seen in the picture below.

Figure 17: Orange power cord

To the left of the caretaker control tower, the motor is attached to the frame. The motor is a Dayton 1Z831 Gearmotor and is used to rock the chair. Connected to the motor is a gear that gears the motor down in a 3-to-1 ratio, which provides the necessary torque to move a user of significant size. Connected to the gear are the cam and linkage bar systems, which translate the rotational forces provided by the motor and gear into a motor elliptical motion and allow the chair to be pivoted about its hinges via the connection point at the back of the chair. A picture of the device, seen below, has been taken encased in Plexi-Glass again in order to offer the operator an idea of how the system sits on the device. But again, the system has been encapsulated in white PVC plastic sheeting for aesthetic reasons.

Figure 18: Complete drive system
Inside the back of the chair are the speaker box and antenna, which cannot be seen in any photographs of the completed device. The speaker box is made of grey PVC and houses two MA Audio® HK-35 Full-Range Speakers. Each is 3.5 inches in diameter and provide a quality overall sound output. The box is attached directly to the frame of the chair at the top of the back of the chair. The antenna has been placed in the right side of the back of the chair on the outside of the foam padding so as to be able to receive radio signals better. A photo of the speaker box while still in construction can be seen below. Also, a picture of the antenna can be seen below.

![Figures 19 & 20: Incomplete speaker box (left) and antenna for radio reception](image)

The final major parts of the device are the end caps and extrusion covers from 80/20, Inc. They provide a more finished look to the device and help keep dust and debris from getting stuck in the extrusion. A picture of both an end cap and extrusion cover can be seen below.

![Figure 21: End cap and extrusion covers](image)
1.2) Step-by-Step Instructions

- Setting up the Rocker

1.) Position the device so that it is in a flat, open area (see picture below). Recommended positioning includes placing the device near a window for better radio reception, if possible.

![Figure 22: Proper positioning for the chair.](image)

2.) If the back of the chair is folded down, do not sit on the back. Instead, lift it up until it locks into place. See the figure below.

![Figures 23 & 24: How TO NOT (left) and how TO position the chair back](image)
RUNNING THE ROCKER

CARESTAKER INSTRUCTIONS

○ THE CARETAKER HAS ULTIMATE CONTROL OVER THE DEVICE. CUTTING THE POWER TO THE DEVICE FROM THE CARETAKER SWITCHES OVERRIDES THE USER SWITCHES.

1.) Seat user into chair gently, placing him/her as far back as possible.

Figures 25 & 26: How TO NOT (left) and how TO properly seat the user

2.) Plug Orange Power Cord into wall outlet. Keep away from well-traveled areas and away from moving parts.

Figure 27: Plugging in the Orange Power Cord
3.) On the Switching Box, Make sure that the dial for ROCKING SPEED is turned fully *counter-clockwise* to the MAX position.

![Figure 28: Proper starting position for the Rocking Speed dial](image)

4.) Attach interchangeable user switches in proper positions on the IP/MC Box. The top slot is labeled for the MOTOR control and the bottom is for the AUDIO control.

![Figure 29: Attaching switches into ports](image)

5.) Turn **MASTER POWER** switch to **ON** position (right-side switch on box).

![Figure 30: Turning on the **MASTER POWER** switch.](image)
6.) Turn MOTOR switch to ON position (left-side switch on box).
   a. Adjust speed of rocking with "ROCKING SPEED" dial with a clockwise motion to slow it down until comfortable speed is reached.

Figures 31 & 32: Turning on the MOTOR POWER switch (left) and how to adjust the ROCKING SPEED

7.) Turn on CD Receiver on the unit itself. Tune radio to preferred station using “TUNING” dial (if reception is available), or insert CD desired (CD will start playing automatically upon insertion).

Figure 33: How to turn on the CD Receiver power
Figures 34 & 35: TUNING or inserting CD into CD Receiver

a. For best output, it is recommended to push the “LOUD/RDM” button once to increase sound power.

Figure 36: Activating the “LOUD” function (note the “LOUD” lit on the face)

b. Also, push “AUDIO” button until “BAS” (bass) is displayed. Alter bass level using volume controls at right to desired level. Recommended level is 1 or 2 (max=7).

Figures 37 & 38: Press “AUDIO” until “BAS” is shown (left), then adjust
c. Push “AUDIO” button until “TRE” (treble) is displayed. Alter treble level using volume controls at right to desired level. Recommended level is 7 (max=7).

Figures 39 & 40: Press “AUDIO” until “TRE” is shown (left), then adjust.

8.) Explain to user about his/her instructions of how to operate the chair (see following “User Instructions” section).

9.) When the user is finished using the chair:
   a. Ensure that both the motor and the audio components are stopped first with the user switches. Try to stop the rocking motion with the user switch so that the chair is centered in its rocking motion (not leaned all the way forward or back).
   b. If desired, eject CD from CD player before shutting off device (Hitting the “EJECT” button). Then press the “POWER” button on the CD player face to shut it off.

Figure 41: Powering down the CD Receiver
c. Switch the MOTOR POWER and MASTER POWER caretaker switches to the “OFF” positions on the Switching Box.

Figure 42: Powering down the MOTOR and MASTER POWER switches

d. Unplug the Orange Power Cord from the wall.

Figure 43: Unplugging power cord
e. As a safety measure, unhook the user switches from the IP/MC box by squeezing lightly at the sides and as close to the ports as possible and pulling back.

**Figure 44:** Unplugging user switches

- **USER INSTRUCTIONS**
  1.) Sit gently into chair, as far back in chair as possible.
  2.) Once caretaker has turned everything on, push the switches to activate either the audio system or the rocking system. Control the rocking motion with one switch and music with the other.
  3.) Sit back and enjoy a relaxing rock!
2.) MAINTENANCE

Please do the following to extend the life and appearance of your chair:

- Spot clean chair fabric with mild soap and water. Do not bleach.

Figure 45: Spot clean
Figure 46: Cleaning

- Wipe plastic surfaces with surface cleaner and a damp paper towel or sponge.

- Do not play speakers at maximum volume for prolonged periods of time.
Figure 47: NO TUGGING!

- Be careful to minimize stress put on the power cord. Do not tug, pull, or place cord where it can be easily tripped over.
Figures 48 & 49: How TO (top) and how to NOT remove the cord from the wall
- When removing the power cord from the wall outlet, grasp the plug head nearest the wall. Do not pull on the cord.
Figure 50: Do NOT pull on wires!
- Be careful to minimize stress placed on switch cords. Do not tug or pull violently.
Figure 51: No explosives

- Be careful to avoid placing and lighting explosives on or around the chair.
- Place chair on level ground while rocking.
Figure 52: No smoking in chair!

- Do not place burning objects such as candles or cigarettes on or near the chair.
Figure 53: Don’t pull on the skirt

- Do not pull on the chair skirt.
- Store below 200° F.
Figure 54: Avoid sharp objects
- Keep sharp objects away from chair.

Figure 55: No aquariums on the chair
- Keep large quantities of liquids away from the chair.
3.) TECHNICAL DESCRIPTION

a) Overview

The optimal design from last semester was the inspiration for the design of the prototype. The framing was designed to be constructed using stock aluminum as described, but was actually built using 80/20 extrusions. This greatly increased the ease with which the frame was built. The hinge mechanism was constructed using an 80/20 hinge part with some modifications. The hinge attaches to another 80/20 frame which was screwed onto the chair. The CD player and caretaker controls were built onto an 80/20 tower at the back of the chair. The speakers were built into a plastic case within the chair. The user switches were designed to be moveable so that a chair user can place them in his or her lap. A 1/6 HP motor is used to rock the chair. The speed of the rocking is adjusted by a series of gears to be slower than the motors rotational speed. From these gears a cam drives the shaft that rocks the chair. All of the wiring is enclosed in the extrusion network.

b) Subunits

Mechanical subsystem
BASE FRAME

The base frame for the chair was built from 80/20 extrusions. The frame lengths were secured to each other with two-hole hinge brackets. The hinge was attached to a cross-brace. Five-hole mounting plates were used to ensure a secure connection between the hinge and the frame. Two cross-braces are used at the back of the frame in order to accommodate the motor and the caretaker tower. The overall length of the frame is 48 in. and the width is 28 in.. The motor cross-braces are placed 6 3/8 in. on-center from each other. The hinge cross-brace is 17 in. from the closest edge of the motor cross-brace.
UPPER FRAME

Figure 57: Upper frame design and completed assembly

The upper frame was also built from 80/20 extrusions. The frame is L shaped to allow for seating of the legless rocker. Cross-braces and corner brackets are used throughout in order to secure the frame. An additional reinforcement made of 1 in. x 4 in. aluminum was added to the back of the upright of the frame to keep it from twisting against the chair. This piece was prone to twisting because the motion of motor and cam system causes it to pull down on this frame piece. The addition of this extra support solved the problem. Two cross-braces were used to attach the hinge mechanism to this part of the frame. This allows for a strong and adjustable connection between the two frames.
The chair hinge was built from modified 80/20 parts. For the pivot point, a 90° active pivot hub was used. This attached to cross-brace on the base frame. Modified three-hole plates were attached to the cross-brace on the frame. The original pieces were too large and too thick at the pivot location, so 0.27 in. was milled from the radius and the thickness decreased to .22 in. in the machine shop. The milled pieces could then fit correctly onto the pivot hubs. The plates were attached to the cross-braces on the upper frame. The hinge can slide both back and forth and from side to side in order to optimize its position on the frame.
MOUNTING OF CHAIR

The chair was mounted the frame using a series of metal plates. Two plates were used on each side of the chair base to attach it to the frame. A third plate was used on each side to attach the chair to the upright part of the frame. This third plate also helped spread out some of the force of the rocking mechanism along frame. The plates were bolted to the frame and screwed to the chair.

ANALYSIS OF ROCKING FORCES

Before the motor and cam system could be attached to the chair and frame, its position and dimensions needed to be determined. This analysis was done primarily in Working Model 2D. A scaled model of the chair was made from measurements of the assembled frame.

![Force analysis drawing](image)

From the analysis, it was determined that the linkage bar should attach as far up on the frame as possible. The ideal position for the cam was also determined to be 14 in. behind the chair, as measured from the back of the chair frame. The resulting dimensions for the cam and linkage bar themselves will be discussed later.

The maximum torque for a 190 pound person was calculated to be approximately 45in-lb for the ideal seating position. For safety and durability reasons, a motor with a much higher torque capability was be chosen. Initial testing of the chair with a 1/15 HP motor that had 75 in-lb of torque demonstrated a jerky motion for heavier occupants. This problem lead to the use of a larger motor as is discussed later.
MOTOR

The motor used for the prototype is a Dayton 1Z831 1/6 HP DC gearmotor. It runs off of 12 VDC and produces 135 in-lb of torque at 80 RPM. The listed peak amperage was 18.5 amps. Because the motor speed was too high, a gear system was built to slow the rocking speed to 20 RPM. This mechanism is described later. During testing, this motor was shown to run at approximately 2.5 amps with no load and at 5.5 amps while rocking a 160 pound person.

![Figure 61: Dayton 1Z831 motor](image)

The motor was attached to a ¼ in. aluminum plate using screws threaded directly into the motor. This aluminum plate was then attached to the base frame on the two motor cross-braces. The positioning of the motor on this plate was determined by the gears and the ideal position of the cam center.

![Figure 62: Motor schematic](image)
GEAR SYSTEM

The natural speed of the motor was 80 RPM, which is not a safe or comfortable rocking speed. To lower the motor speed and increase torque, a system of gears was attached. A small 12 tooth gear was attached directly to the shaft of the motor. It was secured to the shaft by a 3/16 in. key and a set screw. A larger, 50 tooth gear is driven by this smaller gear. This results in a lower speed and higher torque according to the following calculations:

\[ 80 \text{RPM} \times \frac{12 \text{Tooth}}{50 \text{Tooth}} = 19.2 \text{RPM} \]

\[ 135 \text{in} - \text{lb} \times \frac{3^{\text{\prime}} \text{radius}}{1^{\text{\prime}} \text{radius}} = 405 \text{in} - \text{lb} \]

The largest gear is positioned so that its center is 14 in. from the back of the chair frame, which is the ideal position determined during analysis. It is attached to the same aluminum plate as the motor using four lag bolts.

Figure 63: Gear assembly
The rotational motion of the motor is converted into the rocking motion of the chair through the cam which is attached to a shaft running through the large gear. The cam was machined from a $\frac{3}{4}$ in. piece of aluminum. The cam length is equal to half of the length between the back of the chair at its most forward and reclined positions and the center of the large gear. This distance was determined to be 1.4 in. A step down shaft was used to attach the cam to the large gear. The gear had a shaft opening of $\frac{7}{8}$ in. and the cam had a $\frac{5}{8}$ in. hole. This milling was done on the lathe in the machine shop. The shaft is attached to the gear with a tapered rod that passes through both. The shaft also has a slot for a key milled into it. The key secures the cam and keeps it from slipping around the shaft. A lock screw is also in place to keep the cam from sliding off of the shaft. A 3 in. length of $\frac{5}{16}$' zinc rod was attached to the cam at through a hole 1.4 in. from the center of the shaft. This zinc rod joins the cam and the linkage bar as will be described later. The rod is secured with a lock screw.

Figure 64: Machined Cam
A pivot block was attached to the back of the chair frame to which the linkage bar would later attach. This block transfers the rocking force from the linkage bar to the chair itself. The piece was machined from a cube of aluminum. A 5/16 in. hole was drilled through the piece. A section of 5/16 in. zinc rod was secured through these holes by set screws. The linkage bar system would later attach to this rod. The entire pivot block was screwed onto an aluminum plate by two screws passing through the back of the block. This plate was then attached to the back of the chair frame.

Figure 65: Linkage pivot design and assembly
LINKAGE BAR

The motor and chair are tied together by a five part linkage bar. The main portion of the bar is a 3/8-32 threaded rod. Purchased bearing blocks were used to attach to the 5/16 in. rods on both the cam and pivot block. These blocks help lower friction in the drive system.

![Bearing block](image)

**Figure 66:** Bearing block

To these bearing blocks, adapter blocks were attached that allow for the linkage bar to thread in. The adapter blocks were milled to follow the profile of the bearing block bases and have threaded screw holes that match up with the holes in the bearing blocks. The threaded rod was screwed into these adapter blocks and secured with a nut locked tight to the adapter block. This linkage bar design allows for easy adjustment of the bar length by simply loosening a nut and then twisting one end of the bearing block assemblies. The ideal length is one that keeps the back of the chair frame just above the ground at the chair’s most reclined position.

![Linkage bar assembly](image)

**Figure 67:** Linkage bar assembly
Figure 68: Motor and drive assembly
**Electrical subsystem**

**POWER SUPPLY**

The electronics of our chair are powered by a 12VDC power supply. A Meanwell S-240-12 power supply was selected. This supply has an adequate current rating and is compact. A standard extension cord is used to attach this power supply to a wall outlet.

![Meanwell power supply](image)

**Figure 69: Meanwell power supply**

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<th>MODEL</th>
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<td>±1.0%</td>
<td>±0.5%</td>
</tr>
</tbody>
</table>

**Figure 70: Power supply specifications**
MOTOR CONTROL

An MC7 motor controller was originally used in our project to control the motor speed. Though this unit was far more important in our earlier designs, which relied on it entirely for control of the motor speed, it still serves two purposes. Firstly, a potentiometer is wired to the controller that allows the caretaker to slow the speed of the motor. When the potentiometer dial is turned to minimize the resistance in the circuit, the motor spins at the recommended speed of 20 RPM. As the potentiometer resistance is increased the motor slows. Slowing of the motor does have the negative side effect of lowering the voltage which limits the power of the motor. The second, and primary advantage of the motor controller is that it allows for the use of lower amperage switches. The current that passes through the switch while using the motor controller is less than one amp, where as it would be up to 12 amps without the motor controller.

![Motor controller schematic](image)

Analog Control of the MC7 12 to 36 volt Motor Controller
(For testing or local control)

Figure 71: Motor controller schematic
The motor controller is housed in an OKW enclosure with air holes drilled in the box top to allow for cooling of the board. This box also serves as the mount for the interchangeable switch sockets. One of these sockets is wired to the switch pins on the motor controller.

Figure 72: Motor controller

Figure 73: Motor controller case
CD PLAYER AND SPEAKERS

The sound input for our chair is from a Boss Audio CD-3020. The CD player is mounted within an OKW enclosure attached to the caretaker control tower. The player is wired to two MA Audio MK35 speakers. An antenna was also attached to the CD player in order to increase radio reception. This antenna was enclosed within the chair.

The CD player has connections for 4 channels. To increase the signal strength to the two speakers, the negative of one right channel was wired with the positive of the other right channel. The same was done for the left channel.

The speakers are installed within the chair inside a PVC box. The box provides a mounting place for the speakers and protects them. The box was installed behind the user’s head.

Figure 74: Audio system
Controls subsystem

Two control systems are used in our chair: caretaker and user. The caretaker controls allow for master control of all aspects of the chair, and the user controls allow for initiation of rocking and music after they have been turned on by the caretaker.

CARETAKER CONTROLS

The caretaker is capable of cutting power to all parts of the chair. A master power switch cuts power to both the CD player and motor controller. With this switched turned on, the CD player can be used, but not the motor. With the master power on, turning on the motor power will allow the chair to rock. The caretaker also has control of the potentiometer which controls motor speed. The max speed of the motor is set to the ideal 20 RPM, but the caretaker can vary the speed between 20 and 0 RPM. In the case that an audio or motor circuit breaker is blown the caretaker can reset them on this control panel. The switch box is mounted on top of the CD player case on the caretaker control tower.

Figure 75: Caretaker controls
USER CONTROLS

Two different interchangeable switches are used by the chair occupant. The first is a squish switch. This switch is flipped by simply squishing the foam filled fabric cylinder. The second switch is a touch switch. This switch requires the user to press down on the large spherical top of the switch. Both of these switches were designed with simplicity of operation in mind as they may be used by individuals with limited physical and/or mental capacity. Either switch can be used for the motor or audio. A switch is assigned to one of those two operations by switching two sockets on the caretaker control tower.

Figure 76: Squish and touch switch
The numerous electrical systems of the chair are tied together by wiring hidden within the chair frame. Electrical power is supplied to the chair by a 15' extension cord attached to the power supply. At the power supply, the 120 VAC electricity is converted to the 12 VDC power needed by the chair components. The neutral wire from the power supply runs to the negative power in lead on the power supply and then branches off to the negative power lead of the CD player. The load wire runs first to the master power switch in the caretaker control box. After this switch the wire is branched through both of the circuit breakers. The CD load wire then runs directly to the CD player, while the motor load wire runs to the motor power switch and then to the motor controller positive lead.

At the CD player wires run to the speakers and to the antenna. The antenna wire runs directly to the antenna with no interruption. The neutral wire of the audio output runs directly to the speakers. The positive wire runs to the user control switch sockets and then to the speakers. The control switch socket for the speakers is dual channel as it cuts off both audio channels. The audio will only play with the activation of the user switch. Turning off of the audio by the user will not shut off the CD player though, so sound can be activated again with a second pushing of the same switch.

The motor controller has neutral and load outputs that are connected directly to the motor. Three wires from the motor controller also run to the potentiometer that allows for speed control. Another set of wires runs to the user control switch socket where they are connected through a user switch.

Though only the audio socket is wired for dual channel, both of the switches are as they are meant to be interchangeable.

A wiring diagram is included on the next page.
Figure 77: Wiring diagram
Figure 78: Control tower
Figure 79: Complete chair
c) Safety

Numerous mechanical and electrical safety measures are in place in the chair. Safety is important because the chair will be used by individuals with limited mental and physical abilities.

The large amount of electrical wiring running throughout the chair is a safety hazard. To protect against electrical shock, all of the wires are hidden behind 80/20 extrusion covers. These covers help to give the chair an organized and aesthetic look as well. They also prevent the user from pulling on wires which would damage the chair.

![Figure 80: Extrusion covers](image)

The most dangerous electrical hazard on the chair is the 120 VAC current that enters the power supply. For this reason the power supply is located behind the chair and is encased fully in a Plexi-glass box. The taping over of all exposed wires within this box with electrical tape provides a secondary safety measure.

![Figure 81: Power supply cover](image)
To prevent the extension cord from being pulled out of the power supply or the connections loosened, the extension cord is secured to the frame with zip ties.

![Figure 82: Extension cord stay](image)

The moving parts of the drive system pose a risk to user and caretaker alike. One could easily get a finger caught in between the gears or between the rotating cam and linkage bar. To prevent against this the moving parts are encased in plexi-glass boxes. Though these guards could be broker with heavy force, they provide protection against someone carelessly putting there fingers somewhere they should not be.

![Figure 83: Drive system guards](image)
The chair itself is padded in all areas that will be open to the user. The user control switch holder is padded over as well, to prevent against someone from hitting their leg on it as they pass by.

Figure 84: Padded user control holder
4.) TROUBLESHOOTING

1.) If electrical components do not turn on:
   a. Check to ensure that the outlet works and that the Power Cord is plugged in.

   Figure 85: Is the plug plugged in?

   b. Make sure MASTER POWER switch and MOTOR POWER switch (if desired) are in the “ON” position(s).

   Figure 86: Are the switches on?
c. Make sure dial for ROCKING SPEED is increased to a level where the motor still is functioning.

![Figure 87: Is the potentiometer properly adjusted?](image)

d. Make sure that the circuit breakers have not tripped (button will be raised from the casing of the breaker; red sides of the white button will be showing). Push button back in to complete the circuit again.

2.) If something shuts off without caretaker control/supervision, or from user switches:

a. First, shut off CD Receiver via “POWER” button, as well as MOTOR and MASTER POWER switches (please see following page).
b. Check to ensure circuit breakers are not blown (numbered buttons would be extended out from the box). Make sure to leave some time so that the breaker (which is temperature-operated) can cool back down before pushing the button back in. Button will not stay down until a specific cooled temperature is reached.
c. Check user switch connections for proper attachment and press user switches another time to ensure they are not accidentally off.
d. Make sure that green light on power supply (metallic box encased at bottom of caretaker control tower) is still lit.

3.) If a specific electrical part (switch, circuit breaker, potentiometer) is thought to be faulty:
   a. Using a multimeter, check for its continuity. A switch should break a current if in one direction versus completing it in another direction.
   b. If the part is determined to be faulty and is wired to the device, de-solder it out of place using a soldering iron and soldering vacuum pump.
   c. If any wiring needs to be removed, pull up extrusion covers from the frame.
   d. Replace part and solder into place. Techniques and tips on how to solder can be found on the UConn BME website in the ECG assembly instructions document (http://www.bme.uconn.edu/bme/sendes/Handouts/EKG%20Man ual,9-7-05.doc#_Toc107734175).

4.) If the chair does not move or rock:
   a. Shut off all power and unplug power cord.
   b. Open up the plastic box covering the motor and gearing system.
   c. Try lubricating the gearing system or linkage bars, as well as the hinges under the skirt of the chair.
   d. Check to ensure the linkage bar isn’t at too sharp of an angle to where it won’t properly move.
   e. Once finished, replace covering.

5.) If motor does not work:
   a. Remove motor from attachment points at bottom of frame device with the aid of Allen wrenches.
   b. Detach gearing components with an Allen wrench.
   c. Consult Grainger website to find new/replacement motor.
   d. Install by remounting in same positions, using Allen wrenches.

6.) If CD Receiver stops working:
   a. Detach nuts on outside of CD Receiver case.
   b. Remove plastic covering.
   c. De-solder wires from their positions and remove Receiver.
   d. When a new receiver is found, re-solder into place and mount back into box.
   e. Using access holes on bottom of box, push bolts for mounting brackets on Receiver through the holes and retighten nuts.

7.) If speakers stop working:
   a. Break stitching on right side of chair.
b. Remove back of speaker box.
c. Take out speakers via screws.
d. Replace speakers.
e. Close speaker box.
f. Re-stitch back of chair.

8.) If power supply stops working:
a. Unplug power cord.
b. Take plastic cover off from around the supply.
c. Unhook wires from power supply.
d. Find the same model and strength somewhere and purchase new/replaceable one.
e. Attach wires in proper positions and re-close box.

9.) If extrusion cover or end cap comes out of place:
a. For extrusion cover, use two hands and push strongly down onto cover in order to put back into place.
b. For end cap, push center insert back through the end cap and then into the hole in the extrusion.

10.) In case of emergency, unplug device from wall immediately. Do not pull on cord, but instead at the outlet.