TAPE RECORDERS

BY RAFAEL LOZANO-HEMMER

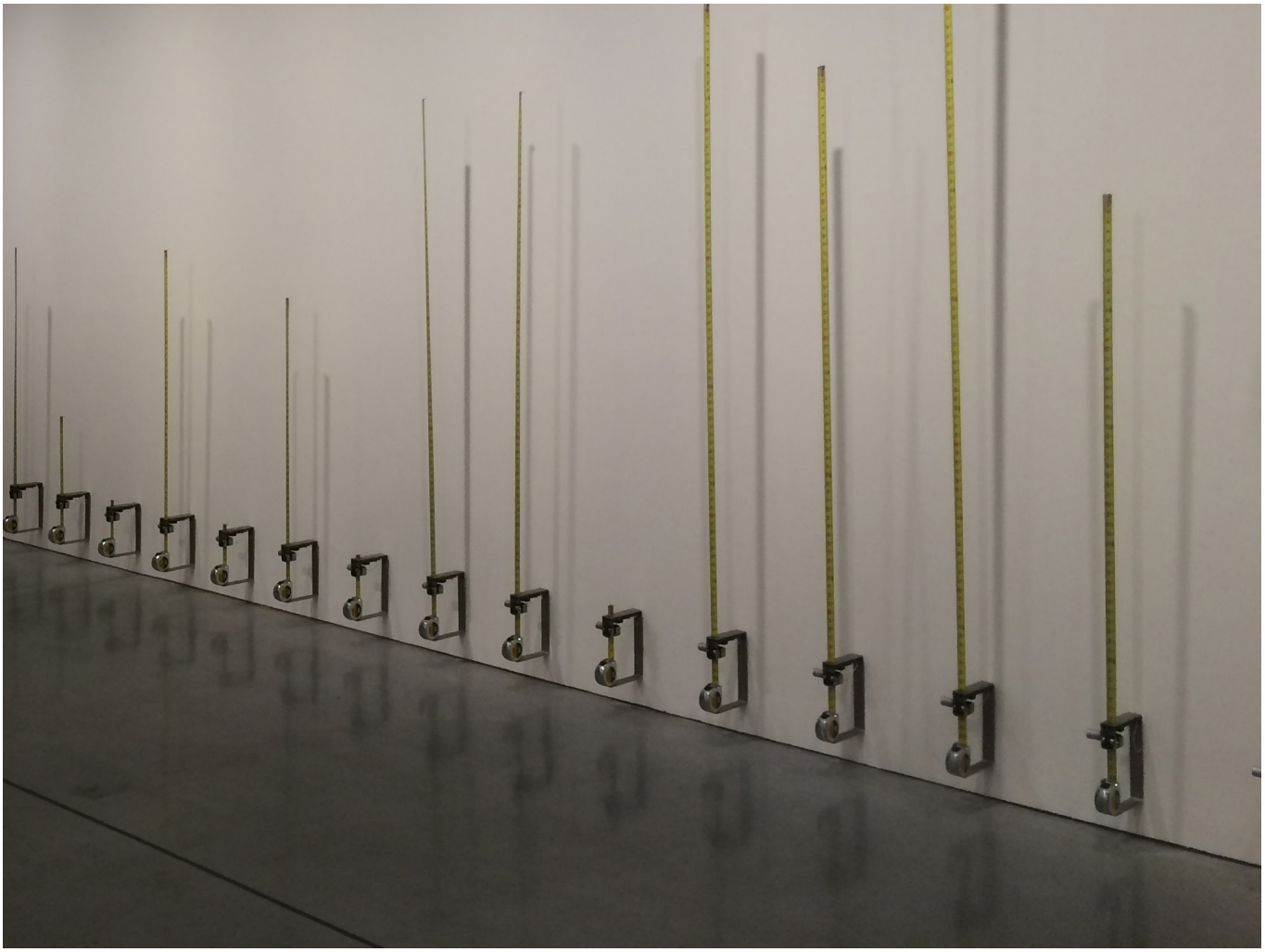


TABLE OF CONTENTS

GENERAL IMPORTANT INFORMATION

This short section must be read for proper operation

TAPE RECORDERS (2011)

BY RAFAEL LOZANO-HEMMER

Technique

Motorized measuring tapes, kinect tracking systems, computers, cameras, thermal printer, custom-made hardware and software

Description

Rows of motorized measuring tapes record the amount of time that visitors stay in the installation. When the computerized tracking system detects the presence of a person, the measuring tape in front of them starts to project upwards. When the tape reaches about 3 meters, it crashes and recoils. Each hour, the system prints the total number of minutes spent in front of the installation by the visitors.

Operation

**** Please refer to "Appendix I - Installation" on page 27 for components placement and wiring diagram. ****

1. Connect the computer(s), the Kinect(s), the local USB extender(s), the printer and the tapes to electrical power. Make sure a display or a HDMI headless adapter is plugged to each computer. Use the supplied power cables. **MAKE SURE THE POWER WIRES ARE SCREWED ONTO THE TAPE BOARDS BEFORE CONNECTING THE POWER SUPPLIES TO ELECTRICAL POWER.** Please refer to the placement instructions section for a step by step explanation.

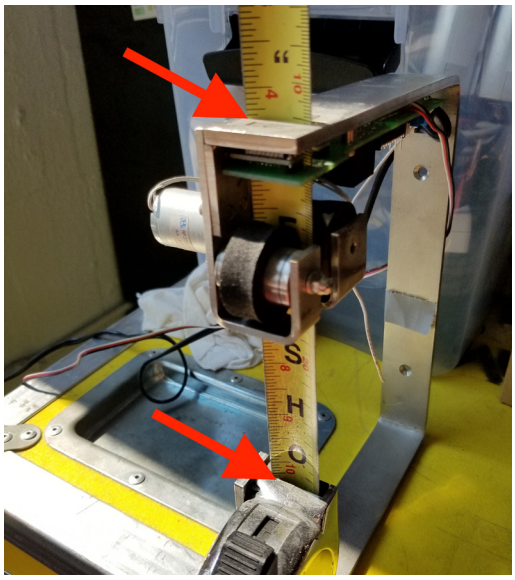
2. When the tapes are connected to power, they will initialize: the micro-controller LEDs will light up and the measuring tapes will go up a few inches and down once. After the initialization, LEDs will keep on blinking on a regular pattern and tapes will be out about one inch above the top of the metal frame. It means the units are ready.

3. To turn the piece ON, press the power button of the computer for a second then release it. **Important note: PLEASE DO NOT PUSH THE BUTTON AGAIN AS THIS WILL SHUT THE COMPUTER DOWN. Wait at least 2 minutes before pressing it again as the computer might take that long to boot.** After 2 minutes (maybe faster), the piece softwares should be running and the tapes should be reacting when walking in front of them. The softwares turn on automatically.

4. If the piece doesn't start within 2 minutes, try to turn on the piece again. If it still doesn't turn on, then hold the power button all the way down for 10 seconds. Then, wait at least 3 seconds and press the power button all the way down for 1 second and you should be up and running again.

Maintenance

It is recommended to clean the gap where the measuring tape recoils and the top of the frame where the sensors are (see red arrows), as black dust from the foam and rubber wheels will leave residue over time. A regular duster or a dry microfiber cloth will work.



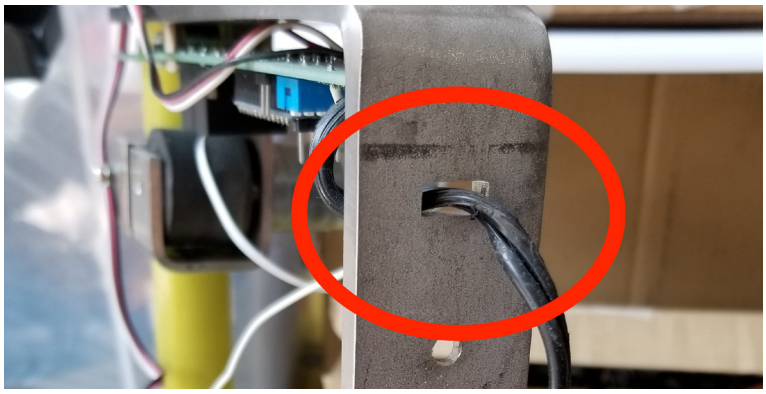
Placement Instructions

1 - Placement on the wall

The first thing to do is to determine where the tapes will be mounted on the wall. There should be at least 25cm between each tape and the bottom of the metal bracket should be at least 30cm from the floor. Mark the place where each tape will be. Making corners with painters' tape works well.

2 - Drilling and cabling

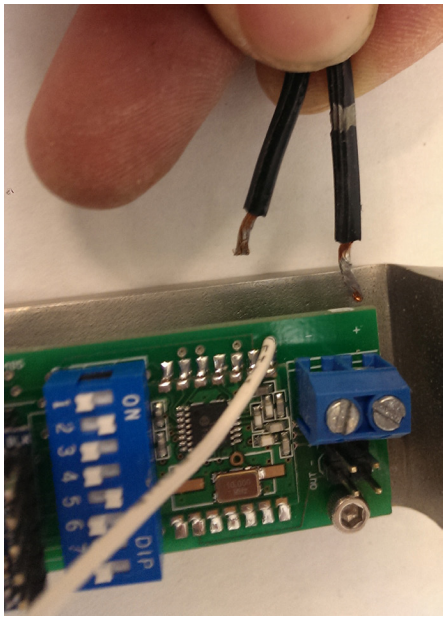
Power supplies for the tapes will be located on the other side of the wall: only the connecting wires will be visible. Holes big enough to accomodate these wires need to be drilled behind each tape (**1/4" or 5/16" work well**). Using a pencil and a tape as reference, mark the spot where the holes need to be. It has to be located right behind the square hole at the back of the bracket. Once the holes are drilled, power supply cables can be fished through the wall.



3 - Mount tapes and arrange cabling

Pass the wires through the hole on the bracket as shown in the above photo and screw the tapes to the wall. Tapes should have a number behind the bracket: make sure you place them in order. Each tape has a unique ID, which is set by a DIP switch on the logic board of each tape (refer to the “DIP switch ID list” on page 30 for a list of addresses). At this point in the mounting process, washers can be added behind the top portion of the bracket: giving the bracket an outward angle prevents tapes from crashing back towards the wall and allows them to crash earlier if distance is an issue.

Screw wires to the power terminal located on the green logic board. Power supply cables have 2 wires: + and - . The positive wire is identified by a silver mark.



Finally, connect the power supplies to the provided extension cords and these cords, in turn, to electrical power.

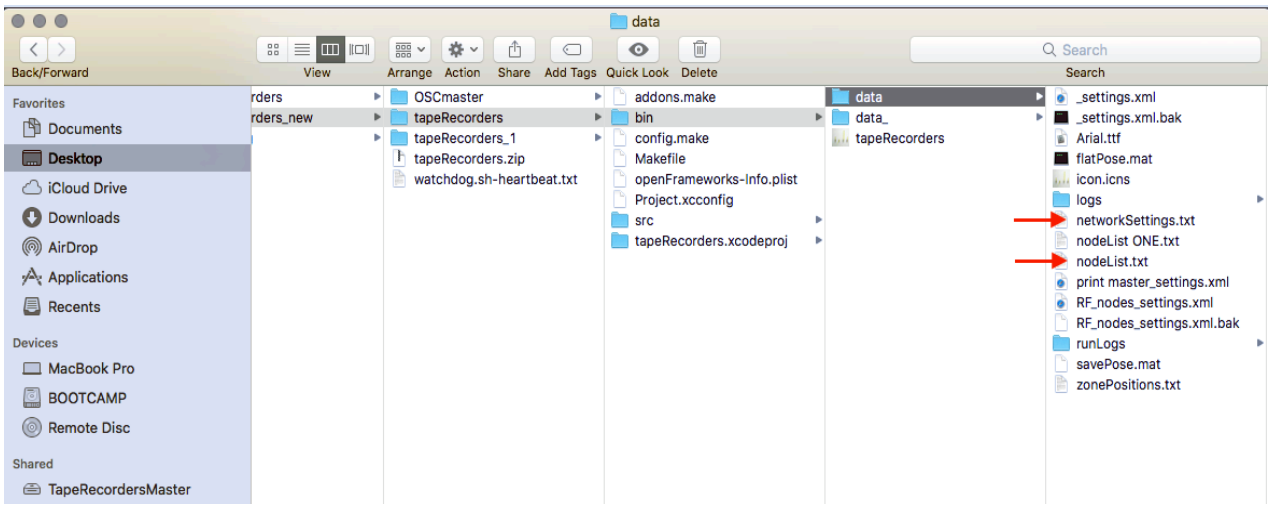
DETAILED TECHNICAL INFORMATION

Software

1 . Setting up text files and IP addresses

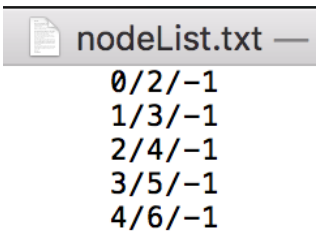
Before calibrating the piece, computers need to have the right IP addresses and there are a few values that need to be entered manually in the data folder text files.

You will need to open these two documents:



List of zones

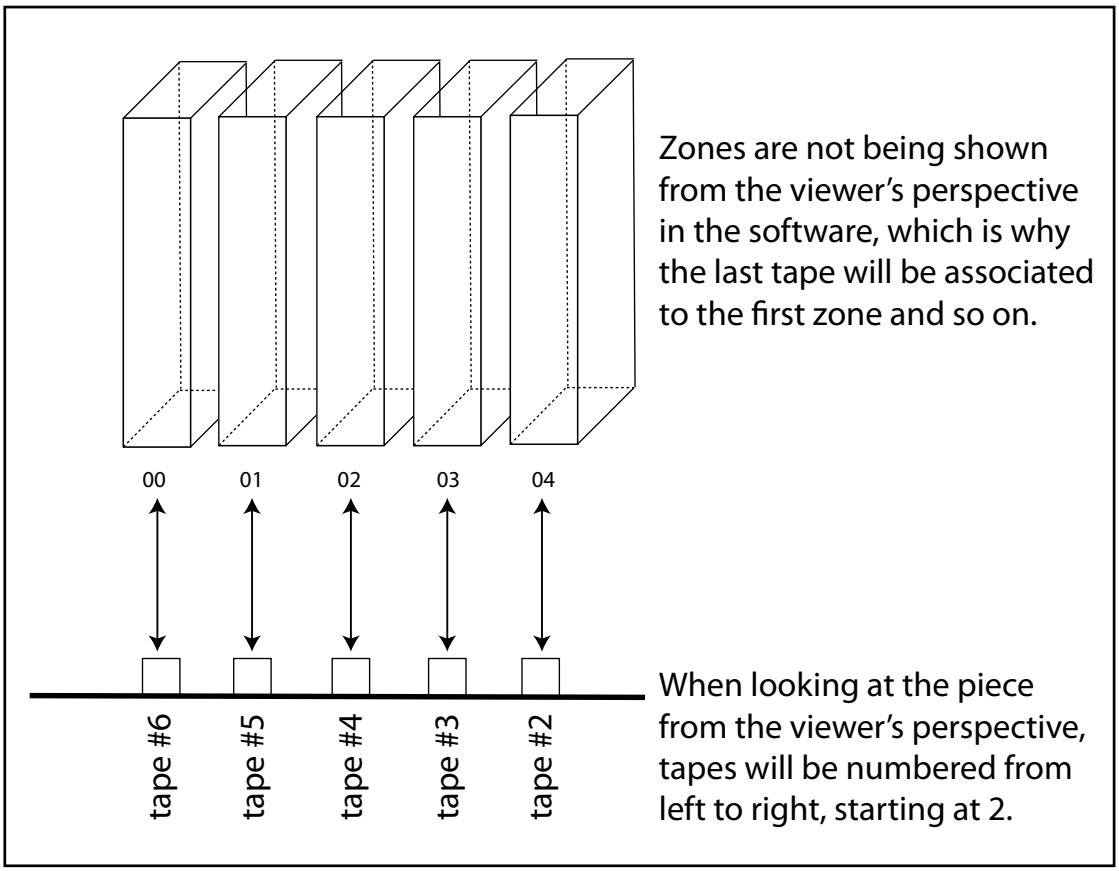
- In the app folder, go to bin/data. You will find a .txt file called *nodeList.txt* : this is where each tape have to be assigned to a specific zone, so that the right tape reacts when walking in the zone directly in front of it. Manually type the right values as follows, and do it for each computer:



zone / tape ID / -1

- The first number is the zone: first zone of first computer is 0. Each subsequent zone is numbered 1,2,3,etc. The next computer will pick up where the first computer left, meaning it doesn't start at 0 again. In the example above, the first zone of the second computer would be 5. The second number is the tape ID. Ideally, the tapes will be mounted on the wall in order, meaning the first tape on the left will be #2, the second #3, etc, but they will most likely be associated in reverse (see image below). **IMPORTANT NOTE: THE TAPES IDs START AT #2. THERE ARE NO #0 AND #1 TAPES**

- Do not change the last number. **It always stays -1**. Save the .txt file(s) and close.



zone association with the tapes

Network settings

- In the app folder, go to bin/data. You will find a .txt file called *networkSettings.txt* . Enter the correct IP addresses in the space indicated below and do it for each computer.

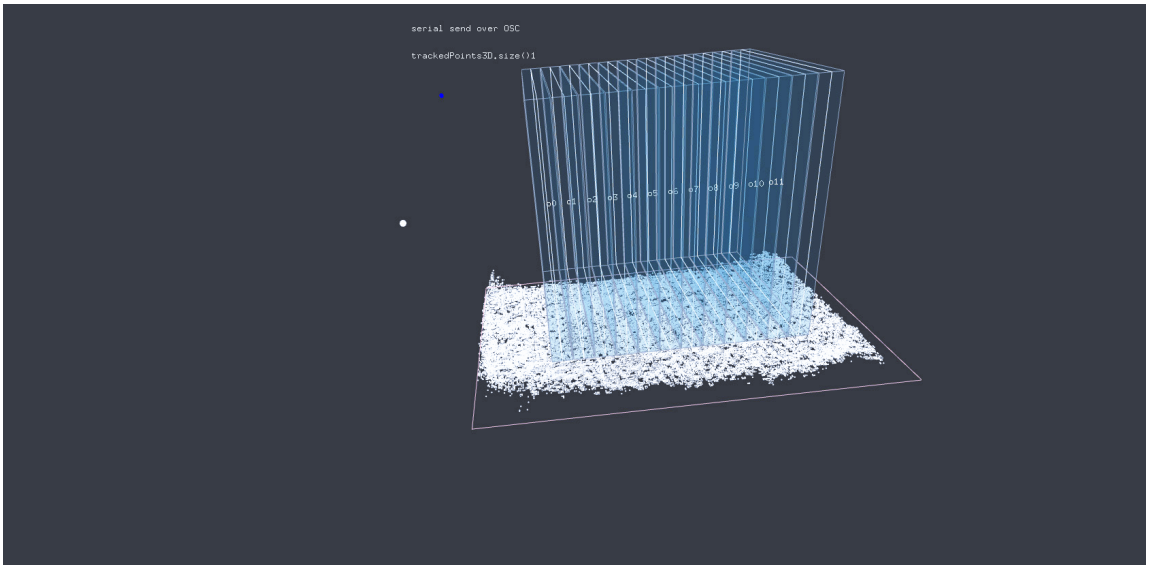
```
//masterIP *.*.*.101,remotePort,localPort
199.168.2.101,44999,11999
```

Please see section about "Specific network configuration" on page 23 for how to set up IP addresses.

2 . Accessing the piece's menu - calibration

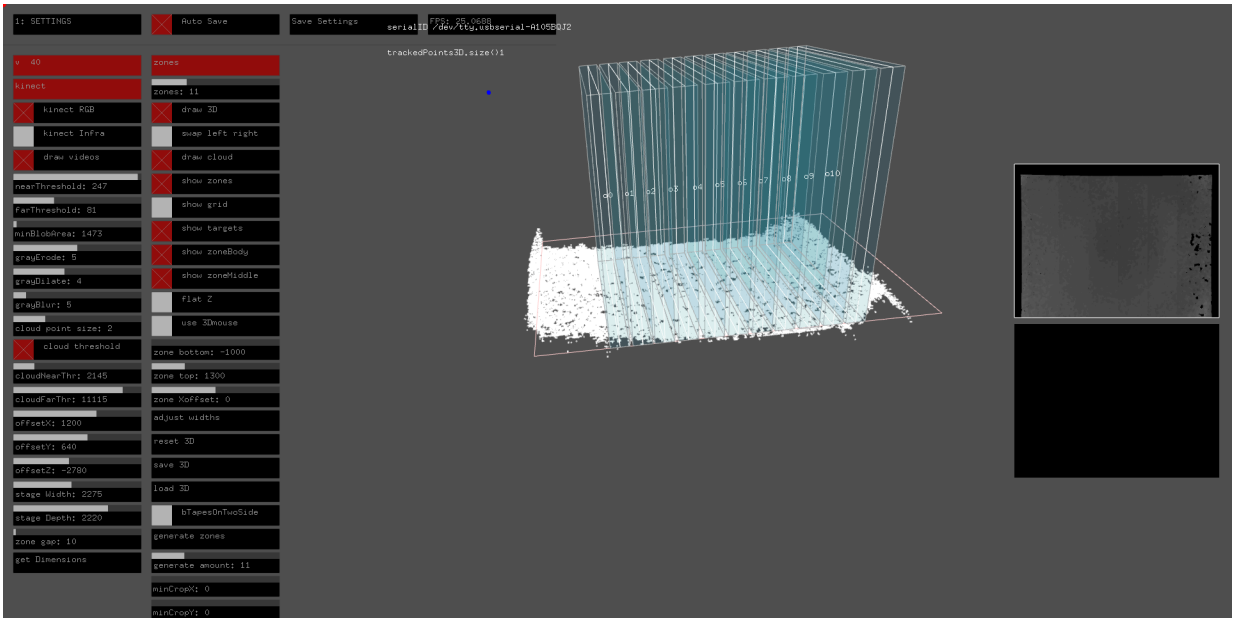
This piece runs on 2 different softwares. The master computer will run both the piece main software and the OSCMasterDebug. Each slave computer will only run the piece main software.

Piece software looks like this:



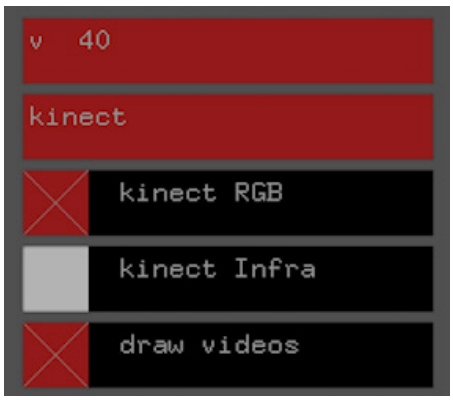
In the piece software, each prism is a zone tracked by the kinect. For the piece to be fully functional, the gap between the zones and the size of the zones need to be adjusted depending on the room, the height of the ceiling and the distance between the tapes on the wall. When someone is detected, their silhouette will appear in the form of a pointcloud. If that pointcloud is big enough, there will be a blue dot inside of it, indicating that this pointcloud, if within one of the zones, will trigger the tape associated to it.

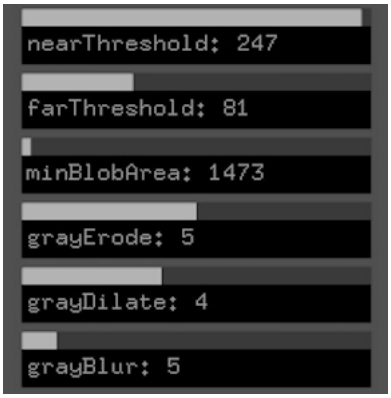
In order to access the GUI (graphical user interface), press the G key on the keyboard. The menu will open like this:



Calibration settings - first tab

There are 3 tabs in the GUI. To navigate between tabs, use the tab key on the keyboard. This section will cover each menu in depth with explanation about each menu feature. The first thing to do to calibrate the piece is to have the Kinects and the software on. It is easier to do the calibration with someone else walking around the piece: it allows you to adjust each setting while seeing the immediate effect.

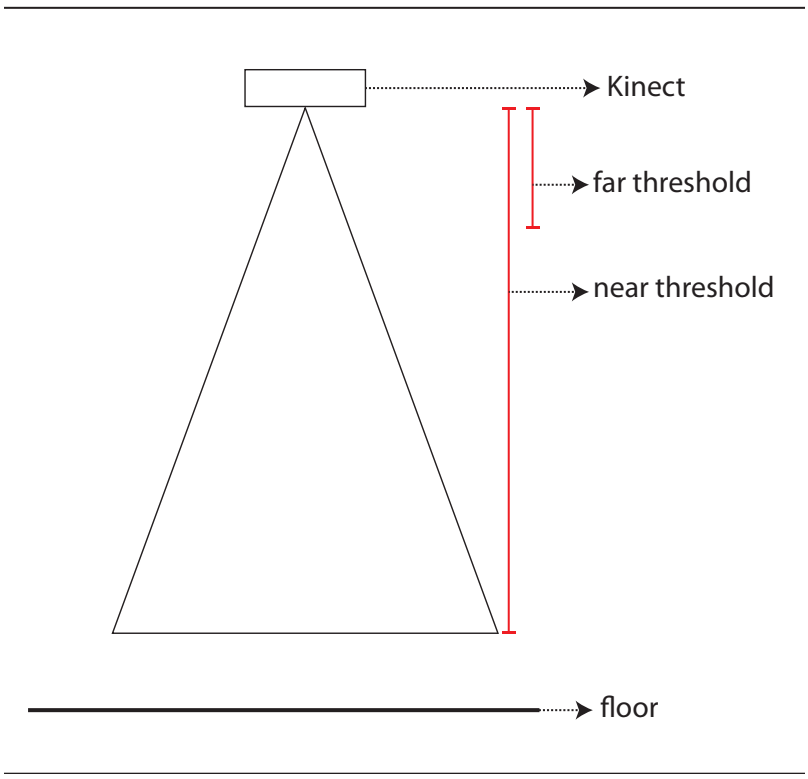




Kinect RGB and draw videos should be checked.

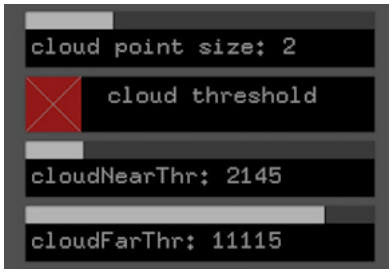
nearThreshold : determines how far the Kinect will track, from its edge to the furthest point we want to use. This is how we assure the floor is not constantly tracked. (see image below)

farThreshold : determines how close the Kinect will track: removes a specified area of tracking from the edge of the Kinect to a specified point, in cm. This is how we assure the ceiling elements, like lights and anchors, are not constantly tracked. (see image below)



minBlobArea : This is the minimum size blob the Kinect will consider to be a valid target for triggering tapes. By adjusting this setting we make sure small objects such as things on the floor, light fixtures etc. will not trigger the piece.

grayErode, grayDilate and *grayBlur* : will help cleaning the blobs and reducing noise in the tracking.

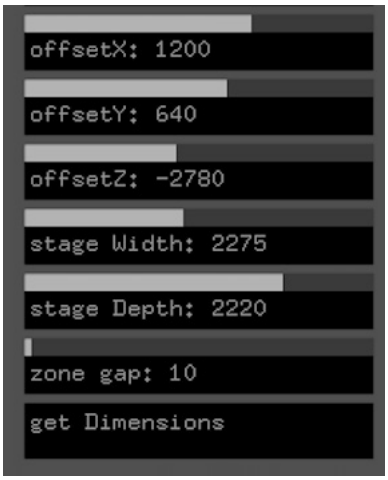


cloud point size : Do not change. Should be set to 2.

cloud threshold : once checked, will eliminate all the point clouds outside of the *near* and *farThreshold* values.

cloudNearThr : Crop the top part of the point cloud (near ceiling) in the visual rendering.

cloudFarThr : Crop the bottom part of the point cloud (near ground) in the visual rendering.



offsetX : Move the point cloud left-right to match it with the stage position.

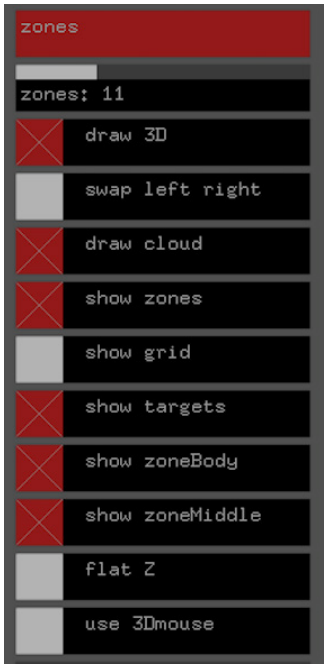
offsetY : Move the point cloud up-down to match it with the stage position.

offsetZ : Move the point cloud left-right to match it with the stage position.

stage Width : Adjust the size of the stage (width – left-right - of zones).

stage Depth : Adjust the size of the stage (thickness – front-back - of zones).

zone gap : This will create a gap between the zones. Only effective once we click on *generate zones*



Zones : has to match the number of tapes controlled by that specific computer

draw 3D : has to be checked

swap left right : leave unchecked

draw cloud : shows the point clouds

show zones : leave unchecked

show grid : leave unchecked

show targets : check to see the blue dots identifying viable targets for triggering tapes

show zoneBody : has to be checked

show zoneMiddle : has to be checked

flat Z : leave unchecked

use 3D mouse : allows user to move the stage around the GUI. Uncheck when done.

zone bottom : Adjust the bottom limit of the zones

zone top : Adjust the top limit of the zones

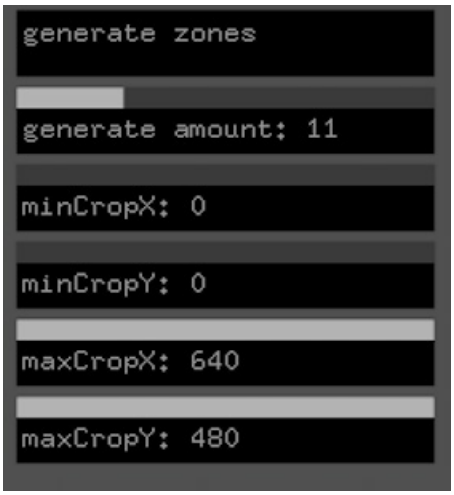
zone Xoffset : move the zones around

adjust widths and reset 3D : not used

save 3D : save the current 3D view as default

load 3D : not used

bTapesOnTwoSide : check this box if you have tapes mounted on 2 walls facing each other.



generate zones : will generate the stage with current parameters

generate amount : should be the same numbers as *zones*

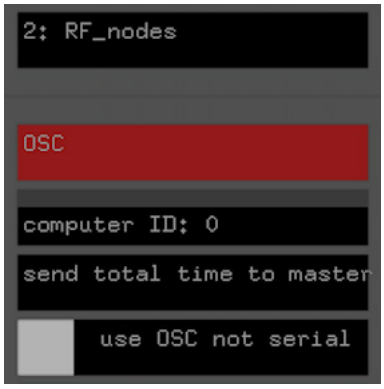
minCropX and *maxCropX* : crop the left edge and the right edge of Kinect grayscale view to define where the Kinect will stop tracking.

minCropY and *maxCropY*: crop the top edge and the bottom of Kinect grayscale view to define where the Kinect will stop tracking.

Final adjustments to the zones:

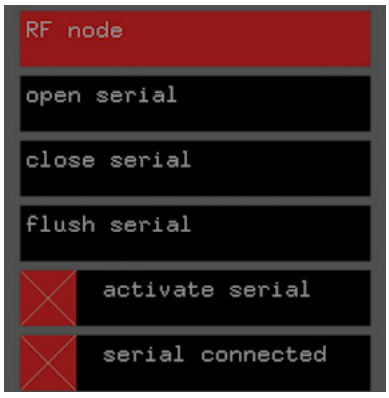
To adjust the dimensions and change zones location within the stage, double-click on a zone. It will highlight it and then, by using the arrows of the keyboard, you can move it left/right/up/down. Adjust each zone's location by having someone stand in front of the tape you are calibrating. Double click on the zone associated with that tape and move it until the zone lights up in red: it means the person is in the trigger zone of that specific tape and that your zone is place correctly. Have the person walk closer/further away from each tape to adjust it's 'up-down' position as well as from side to side (adjusting the zone gap and it's left/right limits), making sure the zone stops before the next tape's zone begins.

Calibration settings - second tab



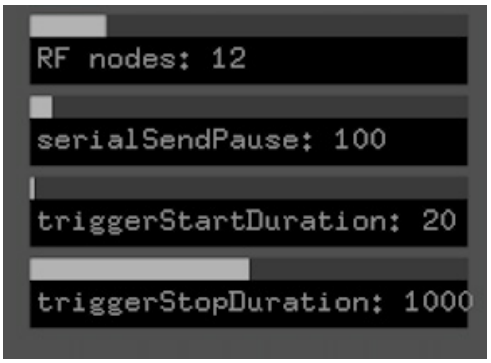
computer ID : the master computer will be set to 0 and the subsequent (slave) computers should be ID'ed 1, 2, etc.
send total time to master : if debug is needed, clicking this will send the total active time of this stage to the master computer

use OSC not serial : do not use.



open serial, close serial, flush serial : do not use.

serial connected : should be checked



RF nodes : To set to the same value as *zones* in previous tab (double the number if on 2 walls).

serialSendPause : Determines how often a new serial command is sent to the tapes. Should be set to 100.

triggerStartDuration : Amount of ms needed to declare point as trigger. Should be set to 30.

triggerStopDuration : Like a fadeout: zone will keep being triggered after a target passed through it. Should be 1000.

This section of the tab allows user to manually test each tape individually or all at once.

test node : set to the ID of the tape you want to test

force command : has to be checked to be able to control the tapes manually. While checked, Kinect tracking will not trigger the tapes. **Has to be unchecked when done testing to allow Kinect tracking to trigger the tapes again.**

in and *out :* will make the specified tape go up and down

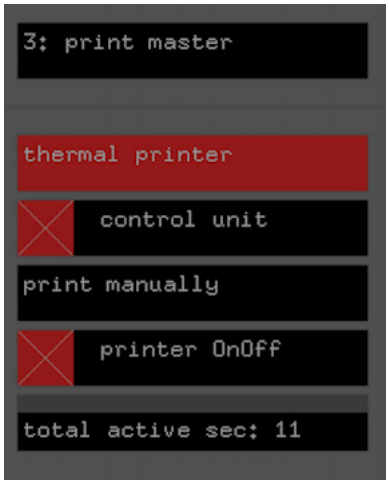
all in and *all out* : will make all the tapes go up and down

stop / all stop : will interrupt the tape motion / all the tapes motion

trigger : not used

all reset : will set them all back to initializing phase

Calibration settings - third tab



This tab contains the printer settings.

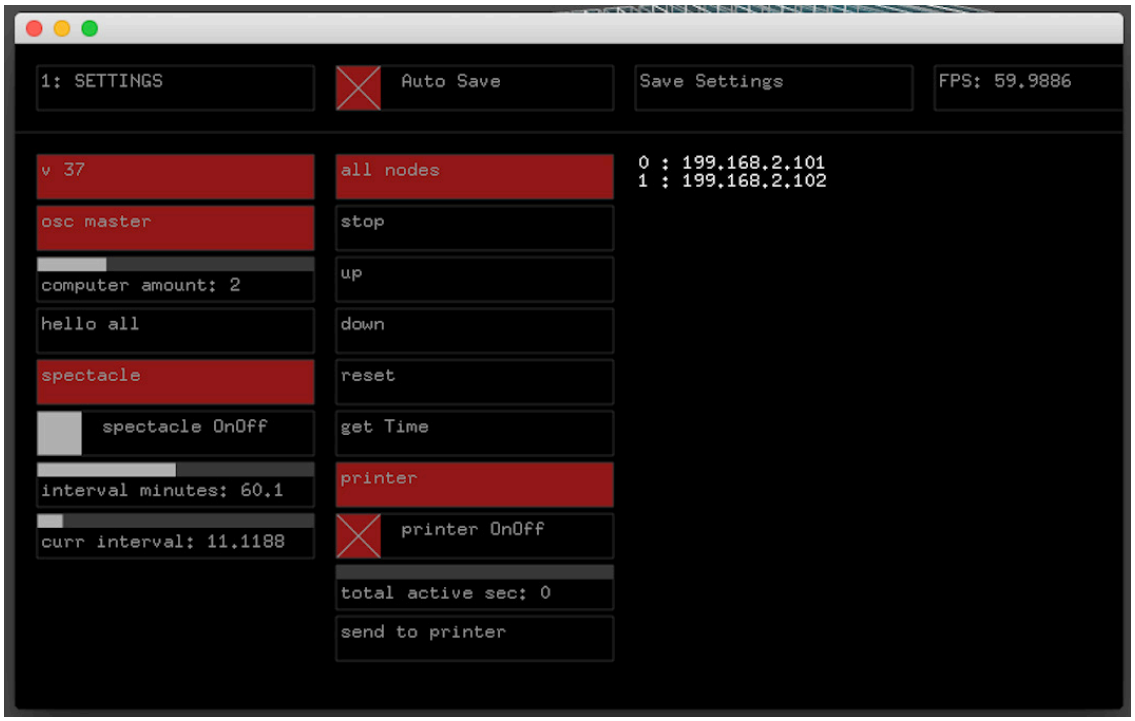
control unit : **should be checked on the Master computer and unchecked on the slave computer(s)**

print manually : not used (performs a test print)

printer OnOff : **should be checked on the Master computer and unchecked on the slave computer(s)**

3 . OSCMasterDebug

OSCMasterDebug looks like this. **It has to run in the background on the master computer only.**



computer amount : value should be the same as the computers needed to operate the piece

hello all : when clicked, will display a message saying ‘hello, computer *x*‘ here, as many times as there are computers operating the piece. When debugging, this is an important thing to check. If one of the computer does not ping, there might be a problem with its connection to the network.

spectacle OnOff : should be unchecked

interval minutes : time, in seconds, between reports of minutes spent in front of the piece produced by printer

curr interval : time, in seconds, elapsed since last printed report

stop, up, down, reset : not used

get time : will display time, in seconds, each computer was ‘‘active‘‘ (tapes in motion) since last report

printer OnOff : should be checked

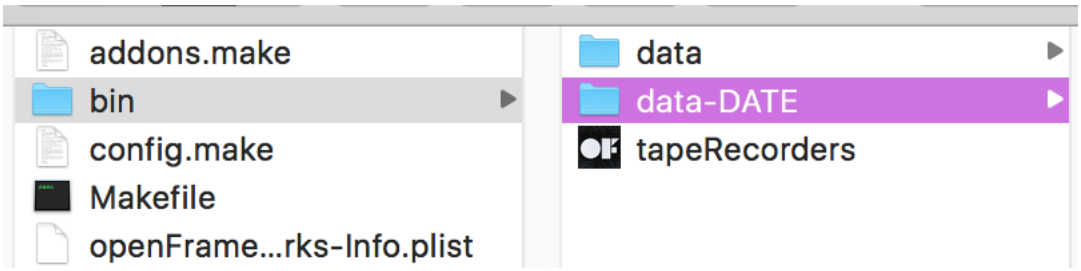
Note: IP addresses of each computer should match the ones listed on the top right of the window.

IMPORTANT:

Once you are done and satisfied with the calibration, it is important to backup the data folder containing all the slider values and settings. That way, if the software crashes or if it needs to be reinstalled, data can be retrieved and the piece can be set up again using the same settings (unless the location changes).

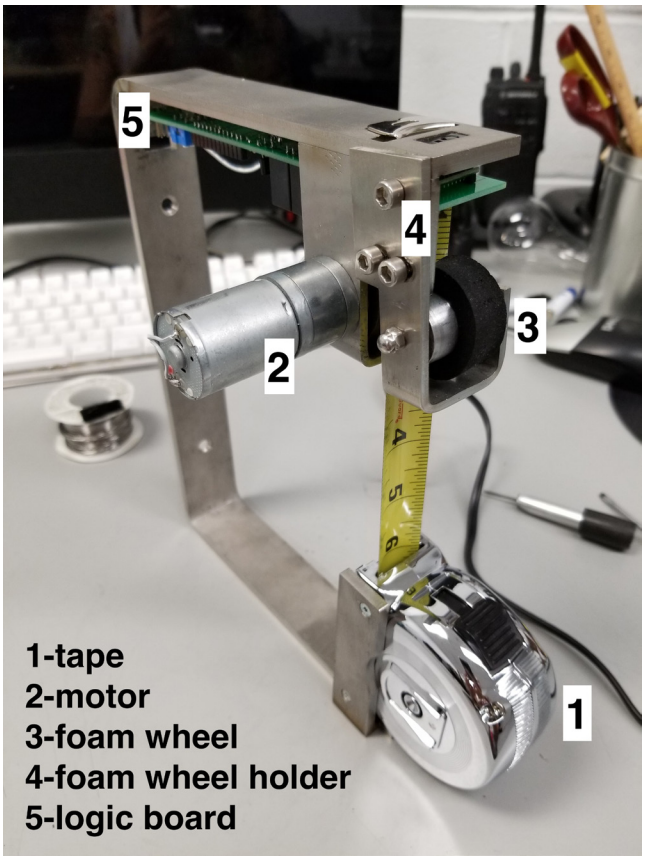
To back up the data folder, follow these steps:

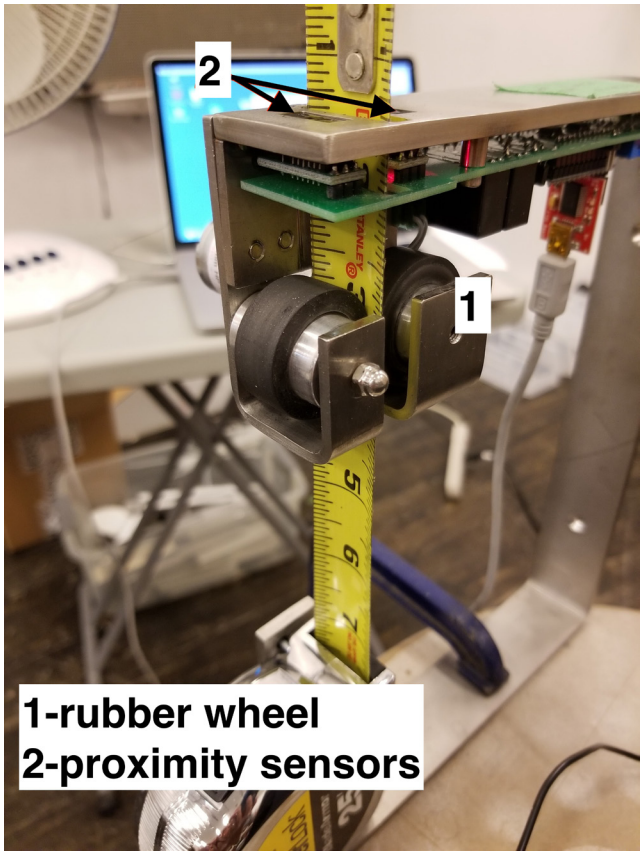
- Right-click on the piece icon (Tape Recorders) in the dock and select *Options -> open in Finder.*
- Once in the app folder, go to *bin -> data*
- Right-click on the data folder and select *duplicate*
- Leave the copy of the folder in the same location. Just rename it "*data-xxxx", xxxx* being the date of backup. If you ever need to use these backed up settings, simply rename it data and replace the data folder in use.



Hardware

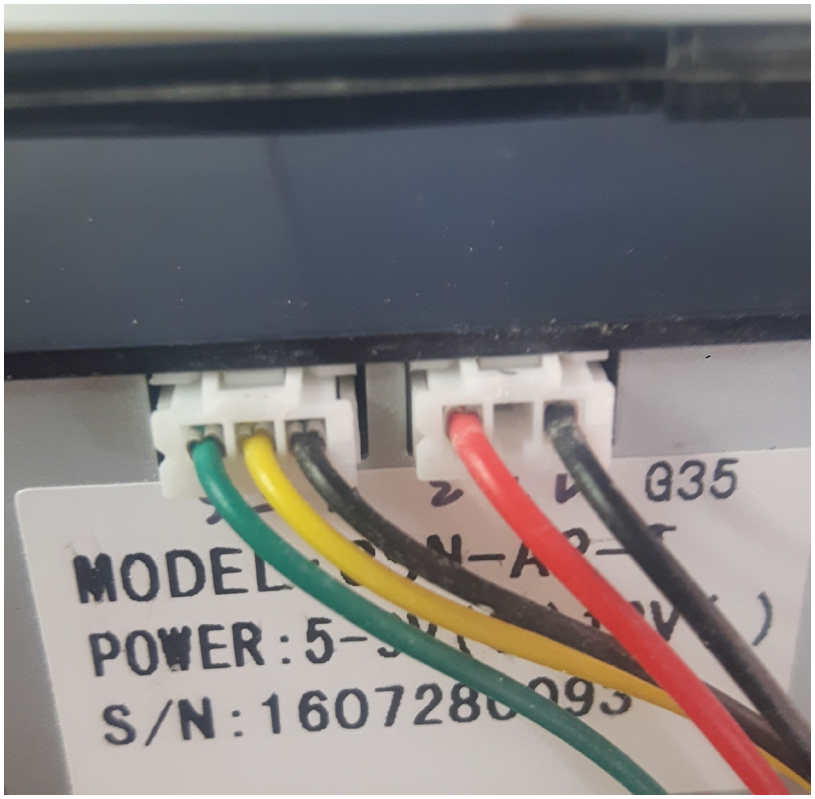
This is the anatomy of a tape unit:





The JeeNode is the module that allows the computer to send and receive information to/from the tapes. It connects to the computer via USB. The white wire, like the ones found on the tapes, act as antennas. It looks like this:

The printer comes with its own power supply, but in case you need to provide your own for length or placement reasons, we use a 5-9V / ~1.5Amp power supply. A logic board similar to those on the tape units is connected to the printer. The DIP switch address should be set to 0. It plugs into the printer like this:



To put a roll of paper in the printer, lift the little lever on the side of the paper door and place the paper in this orientation (or else it will not print):

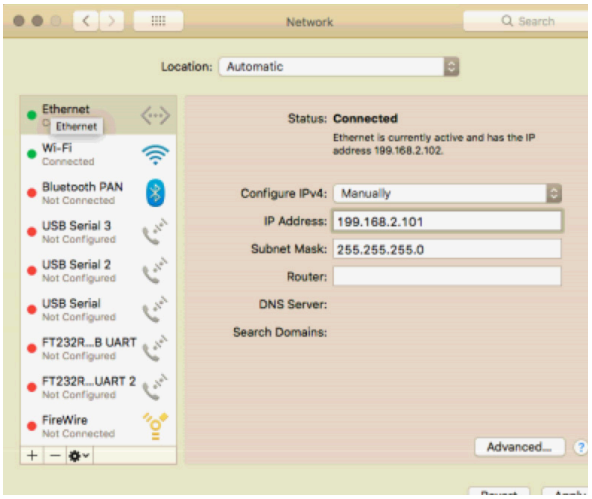
Specific network configuration

This artwork requires a specific IP address configuration in order to work properly. If there are more than one computer operating the piece, they all need to communicate with each other.

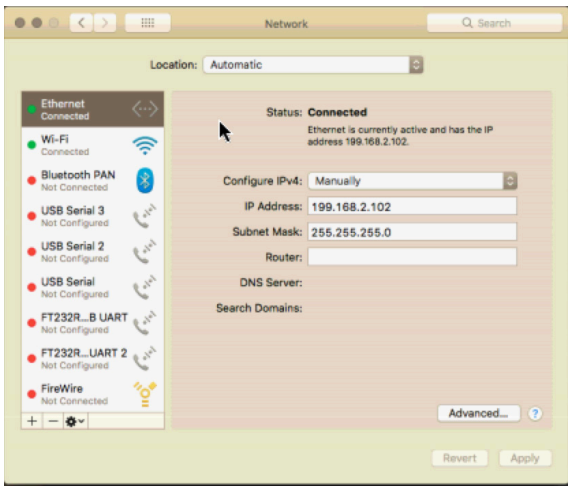
All the computers should be connected to a switch rather than a router. That way, they communicate with each other locally and can still be connected to the venue's Wi-Fi for debug and remote troubleshooting.

In order to do this, the following network configurations are required. In *System preferences - Network - Ethernet:*

Master computer (IP 199.168.2.101)



Slave computer (IP 199.168.2.102)



Each subsequent computer will follow the same address structure: 199.168.2.xxx, where xxx will increase by one every time (i.e computer 1 = 101, computer 2 = 102, computer n = 10n).

Remote access to artwork's computer

LogMeIn is installed on the computers in this piece. This software allows the staff at the studio to connect remotely to the computers running the artwork. This feature is helpful when the venue requires assistance from the studio; we can log into the computers, share their screens and do a quick inspection and debug session from the studio. This should already be installed and configured on the computers prior to installing the artwork. **It only requires that the computer is connected to the Internet at all times.** Please contact the studio if you have any questions about this.

Preliminary troubleshooting steps

In case of a software problem:

You can access the computers, the tape electrical cables and the router from behind the wall. There you should connect a display to the mac minis and use the keyboards that are stored next to the computers. If the applications quit unexpectedly, they can be reopened from the desktop. Master computer needs to run both 'OSCMasterDebug' and 'Tape Recorders' apps. Slave computers need to run 'Tape Recorders' app only.

If one of them freezes or doesn't respond, you can force quit or press escape to close the apps. Reopen all apps and check that there is light on:

- both Black Boxes, if used in your setup (small black devices connected to computers)
- both Kinects on the ceiling (light should be green)
- light on all the tapes

Walk in front of the piece. Tapes should react. It means you're good to go.

If the printer runs out of paper:

Simply pull the little black latch above the green light to open the door. Note the orientation of the paper and place a new one in. Close the door. You should hear a click. The printer should make a sound and print a line.

If the printer stops working:

Carefully take it off the wall support to avoid pulling cables and wires. Check to make sure it's still connected properly. If it is, you'll have to connect a monitor to the computers and make sure the app didn't crash. If so, restart and it should be working again. The correct printer settings are saved in the program.

If a tape gets tangled or doesn't recoil

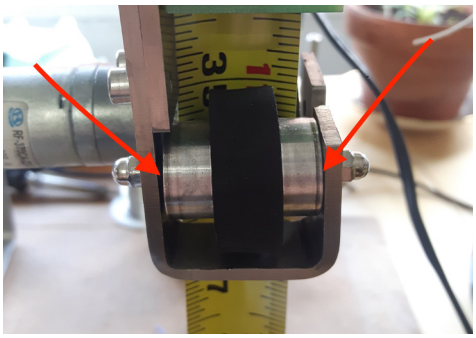
A technician can gently pull or detangle it; it should then activate the sensor and recoil.

If a tape has a hard time going up/down

The tension of the foam wheel against the tape might be off. Tension can be adjusted by loosening or tightening the foam wheel. You need to loosen the 3 small screws holding it in place on the side and place the foam wheel in a better position.

If a tape gets abnormally squeaky

It is possible to add small metal washers on the sides on the foam wheel holder to stop it from rubbing against the metal frame :



A tape is cracked or bent out of shape

Simply change the whole unit for one of the spares provided. Unplug the unit before manipulating it. Spare tape units are provided with the piece. It is a better idea to simply replace the faulty unit with a new one. IMPORTANT NOTE: make sure to give the new unit the correct ID by adjusting the DIP switch (refer to the “DIP switch ID list” on page 30). In case there are no spares left, please refer to “Appendix III - TAKE A TAPE APART” on page 37 **and** to the trained technicians before attempting to repair them.

After manipulating/fixing a tape, make sure the power supply is attached to the board again, plug it back in the extension cord and you should be good to go. If you want to test this particular tape, you can always do so by checking the ‘FORCE COMMAND’ box in the second tab of the software (open the GUI with G, navigate between tabs with tab), select the tape you want to control (tapes are numbered 2 to 24 in the program) and press OUT and IN. It should come out and reel in normally.

If the piece needs to be reinstalled/recalibrated completely:

All the needed data and calibration values have been backed up. It means we can restore the program as it was for it to work in the specific settings of the space. **Please talk to the reference person from the studio before attempting anything.**

Troubleshooting assistance

Prior to contacting Antimodular studio for a problem with your artwork, please make sure you went through the preliminary troubleshooting steps from the previous section.

The troubleshooting process will vary depending on the problem. In order to ease the process, it is recommended that you collect and transfer this information to the studio:

- Date and time when the problem first happened;
- Description of the problem;
- Actions taken so far and conclusions;
- Detailed photographs (or videos) showing what the problem is;
- Detailed photographs (or videos) of faulty components;
- Detailed photographs (or videos) of the whole artwork and its surroundings;
- Personnel involved;
- Other relevant details, such as any changes in the surroundings, different lighting situation, etc.

Support (contact us)

If you require support for the piece, please contact Lozano-Hemmer's studio:

Antimodular Research
4060 St-Laurent, studio 107
Montréal Québec H2W 1Y9 Canada
Tel 1-514-597-0917 Fax 1-514-597-2092
info@antimodular.com
www.antimodular.com

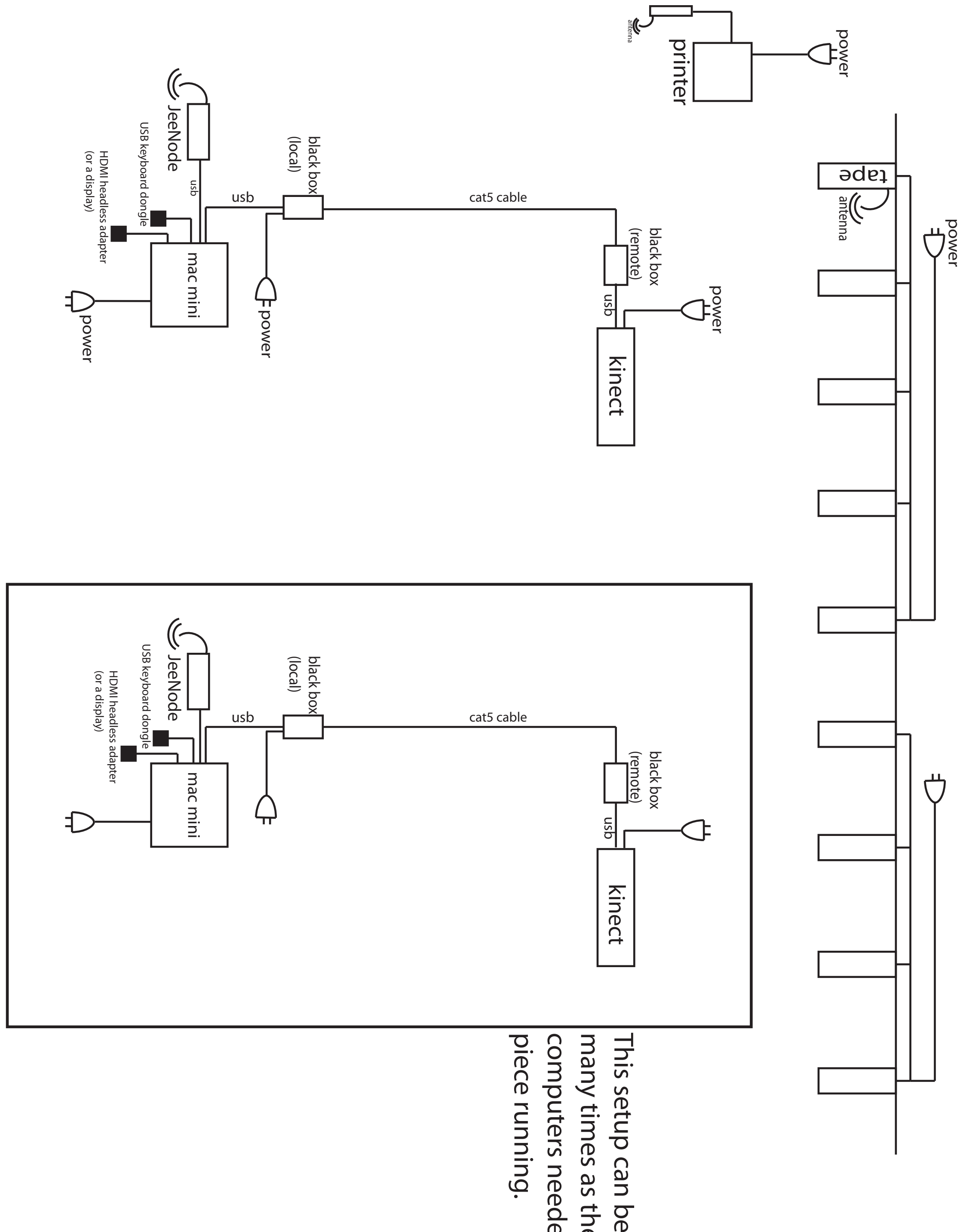
APPENDIX I - INSTALLATION

Components description

This artwork requires the following components:

Component	Description
Computer(s)	Mac minis running at least on OSX 10.6.3
Microsoft Kinect 360	This is the sensor that allows the system to track people present in front of the artwork.
Thermal printer	It has its own power supply and communicates through RFM module on attached logic board.
Black Box USB over cat5 extenders	Might be needed to connect the Kinects to the computers.
JeeNodes	Allow computer(s) to send and receive tape units' data.
Keyboard	While not required for the artwork to run, it is needed to calibrate the piece.

Wiring diagram and connections



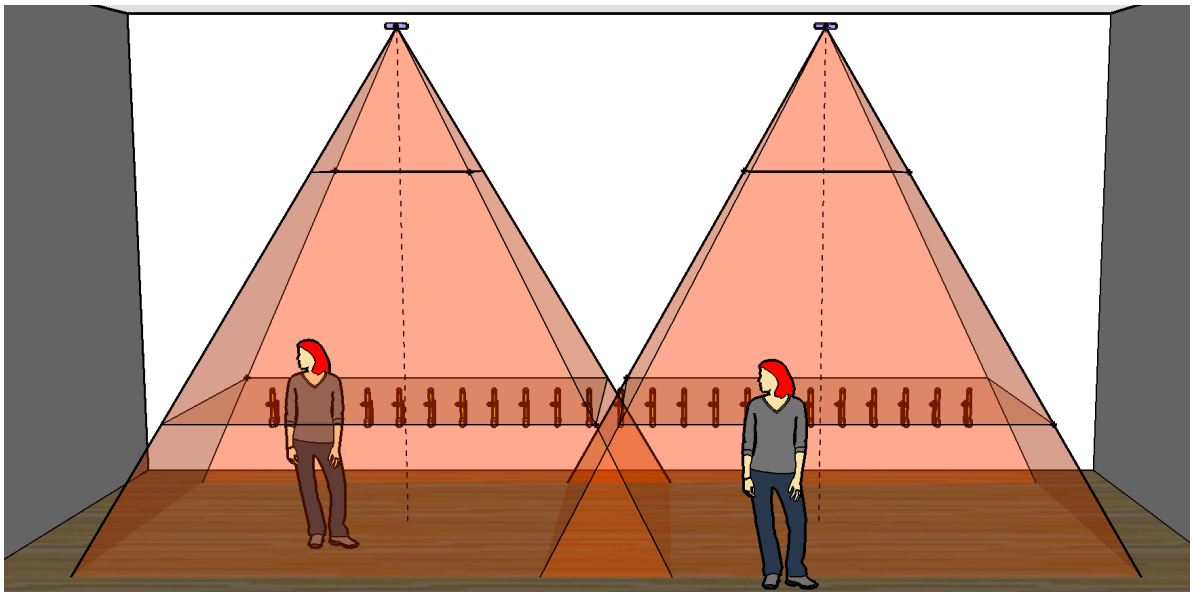
This setup can be recreated as many times as there are computers needed to have the piece running.

How to install the Kinect(s)

Everytime the piece is installed in a new venue, a technician from the studio makes an installation plan according to the room dimensions, ceiling height and possible proximity to other pieces. It is important to provide exact measurements when installing the Kinect(s) for the calibration to work properly.

- The Kinect(s) should be installed on the ceiling facing down, the distance between them should still allow them to cover the whole room (please refer to field of view angles above) while still overlapping in the middle. A wide overlap is easier to work with than a narrow one, seeing as the tracking zones will be delimited later in the software. It is better to have a buffer to work with.

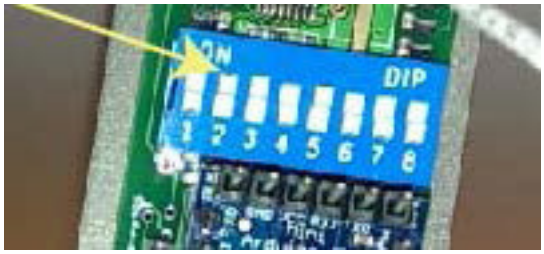
-It should not necessarily cover the whole distance to the floor; because of the pyramidal shape of the covered zone, we want the bottom of this ‘pyramid‘ to be located around knee level. If it covers all the way to the floor, cropping can be done in the software.



DIP switch ID list

0	00000000	**10**	01010000	**20**	00101000	**30**	01111000
1	10000000	**11**	11010000	**21**	10101000	**31**	11111000
2	01000000	**12**	00110000	**22**	01101000	**32**	00000100
3	11000000	**13**	10110000	**23**	11101000	**33**	10000100
4	00100000	**14**	01110000	**24**	00011000	**34**	01000100
5	10100000	**15**	11110000	**25**	10011000	**35**	11000100
6	01100000	**16**	00001000	**26**	01011000	**36**	00100100
7	11100000	**17**	10001000	**27**	11011000	**37**	10100100
8	00010000	**18**	01001000	**28**	00111000	**38**	01100100
9	10010000	**19**	11001000	**29**	10111000	**39**	11100100

To set the DIP switches, use your nail or a small flat screwdriver to flip the switches up for active and down for inactive. For example, tape #14 will have the second, third and fourth switches up while 1, 5, 6, 7 and 8 will be down. Correct UP/DOWN orientation is when the word DIP is not upside down.



APPENDIX II - TECHNICAL DATA SHEETS

Stanley measuring tape

Click to view more



25 ft PowerLock® Tape Measure with BladeArmor®

Classic STANLEY

33-525

★★★★★ 5.0 (1) Write a review

Share

WHERE TO BUY | ADD TO MY TOOLBOX

What is this?

The STANLEY® 25' PowerLock® Tape Rule blade is reinforced BladeArmor coating for maximum durability. The tape has up to an 8-foot standout. To simplify framing jobs, the bright yellow, easy-to-read blade has 16-inch and 19.2-inch stud center markings.

Features & Benefits

- 8' blade standout
- BladeArmor™ coating on the first 3" maximizes durability of the blade
- Mylar® polyester film extends life of entire blade
- Three-rivet, corrosion-resistant Tru-zero end hook for accurate measurements

Product Specs

Blade Coating	Mylar®, BladeArmor®
Blade Length (ft)	25 ft
Blade Standout (ft)	8 ft
Blade Width (in)	1 in
Color	Chrome
Stud Markings (in)	16, 19.2 in

Feature:

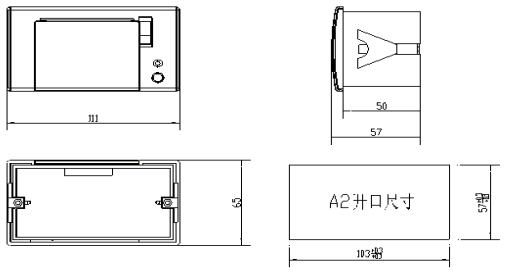
※ Smart appearance
※ Easy paper loading
※ Low noise thermal printing
※ Different interfaces optional
※ Front panel make paper replacement easily
※ Easily embedded to any kinds of instruments and meters

Application:

◆ Oiling Machine print proposal
◆ Queue machine Print proposal
◆ Recording Meter print proposal
◆ Self-service Print proposal
◆ Ticket Machine print proposal
◆ Medical instrument print proposal
◆ Weight Machine Print proposal
◆ Electric Instrument Print proposal
◆ Test Instrument Print proposal

Specification:

Print	Printing Method	Thermal Dot Line
	Printing Speed	50-80mm/s
	Resolution	8 dots/mm, 384 dots/line
	Effective Printing Width	48mm
Character	Character Set	ASCII,GB2312-80(Chinese)
	Print Font	ANK:5×7, Chinese: 12x24,24×24
Paper Spec	Paper Type	Thermal paper
	Paper Width	57.5± 0.5mm
	Paper Roll Diameter	Max: 39mm
Reliability	MCBF	5 million lines
Interface		Serial(RS-232,TTL), Parallel
Insert Depth		50mm
Power Supply (Adapter)		DC5V-9V
Physical	Outline Dimension (WxDxH)	111x65x57mm
	Installation Port Size	103 x 57mm
	Color	Beige/Black
Environment	Operating Temp	5°C ~ 50°C
	Operating Humidity	10% ~ 80%
	Storage Temp	-20°C ~ 60°C
	Storage Humidity	10% ~ 90%



Model No.: A2 Micro Pannel Thermal Printer

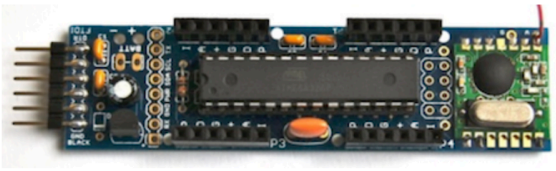
JeeNode

https://jeelabs.net/projects/hardware/wiki/jeenode

JeeNode v6 - JN

Hardware Reference

The **JeeNode** is a wireless micro-controller board designed for a variety of Physical Computing tasks. From measuring and reporting temperature, humidity, and other environmental data to tracking and controlling energy consumption around the house. It was inspired by the Arduino Duemilanove and Uno boards, and by the "Real Bare Bones Board" (RBBB) from Modern Device.



At a glance

What's on a JeeNode v6, from left to right:

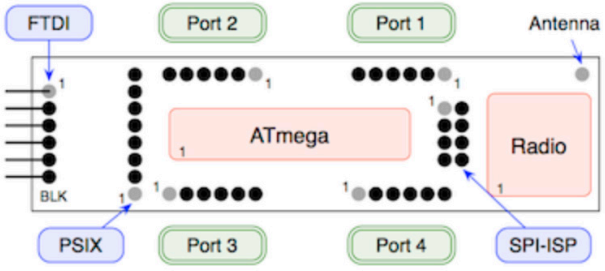
- 6-pin FTDI-compatible serial I/O port, used for power, re-flashing, and communication
- 3.3V power regulator which accepts 3.5 ... 13V as external power source
- 8-pin combined Power / Serial / I2C / Extended (PSIX) connector
- ATmega328P microcontroller by Atmel, with 16 MHz ceramic resonator
- 2x4-pin combined SPI / ISP connector, with 2 general-purpose I/O lines
- RFM12B wireless RF module for the 433, 868, or 915 MHz ISM band, by Hope RF
- short wire - acts as radio antenna (78, 82, 165 mm long, for 915, 868, 433 MHz, respectively)

And on the long sides of the board: two I/O "ports" each, with one analog/digital I/O, one digital I/O, +3.3V, ground, PWR, and interrupt (IRQ) line. All ports have an identical pinout for use with "plugs".

Specifications

Microcontroller:	ATmega328P
Maximum frequency:	16 MHz (down to 3.3V)
Power consumption:	4 µA .. 35 mA
Supply voltage:	3.3V .. 13.0V
Dimensions:	85.9 x 21.1 x 9.9 mm
Weight:	12 g

Connectors & pinout



Port/pin mapping

Port	Name	Extras	Arduino	Signal	Chip
Port 1	DIO1	-	Digital 4	PD4	pin 6
	AIO1	Analog-in	Digital 14 / Analog 0	PC0	pin 23
Port 2	DIO2	PWM (timer 0)	Digital 5	PD5	pin 11
	AIO2	Analog-in	Digital 15 / Analog 1	PC1	pin 24
Port 3	DIO3	PWM (timer 0)	Digital 6	PD6	pin 12
	AIO3	Analog-in	Digital 16 / Analog 2	PC2	pin 25
Port 4	DIO4	-	Digital 7	PD7	pin 13
	AIO4	Analog-in	Digital 17 / Analog 3	PC3	pin 26

Ports 1 .. 4

Pin	Name	Description
1	PWR	external power
2	DIO	digital I/O line
3	GND	ground
4	+3V	regulated +3.3V
5	AIO	analog I/O line
6	IRQ	interrupt (tied to INT1)

SPI / ISP connector

Pin	Name	Description	Pin	Name	Description
1	MISO	master in / slave out	2	+3V	regulated +3.3V
3	SCK	SPI clock	4	MOSI	master out / slave in
5	RST	reset	6	GND	ground
7	SEL0	tied to PB0 (A. pin 8)	8	SEL1	tied to PB1 (A. pin 9)

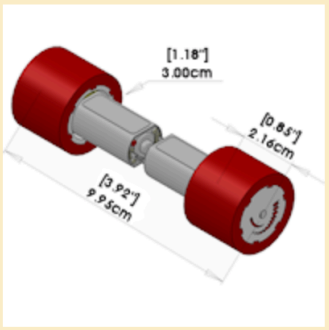
Microsoft Kinect 360

Here are the specifications of the Kinect used by this piece.

Color camera	640 x 480 @ 30fps
Depth camera	320 x 240
Max depth distance	+/- 450 cm
Min depth distance	40 cm
Horizontal field of view	57 degrees
Vertical field of view	43 degrees
Skeleton joints defined	20 joints
Full skeleton tracked	2
USB standard	2.0

Wheels

Description | Specifications | CAD Files | Reviews | Related



Cobra Minisumo Wheels are top-quality competition wheels.
- The fiberglass-infused nylon hubs are designed with a ring of captive holes for locking the tire tread in place.
- Tire tread composed of Shore A20 polyurethane makes these the highest traction wheels you can buy.
- The wheel is designed to envelop a 16mm gearbox. Perfect where length is a concern. (Two Gold Spark motors with these wheels will fit into the 10cm width limit of minisumo events.)
- An extra-long setscrew allows you to easily tighten the wheels onto a 3mm motor shaft.
- Setscrew is accessed through tire. (Don't forget your 1/16" hex wrench)

Description | **Specifications** | CAD Files | Reviews | Related

Specifications:
Hub material: Fiberglass-reinforced nylon - "lock channels" ensure the tread can't peel off the hub
Tire material: Shore A20 polyurethane, professionally vacuum-degassed
Coefficient of Friction (against smooth unpainted MDF wood): μ=1.75 (Silicone μ=1.30, Rubber μ=1.05)
Diameter: 3.00cm (1.18")
Width: 2.16cm (0.85")
Inner diameter: 1.76cm (0.688")
Shaft bore: 3mm (0.118") - you can easily drill the bore for larger motor shafts
Weight: 12.6grams each (0.44oz) - light wheels mean you can add more weight to the bottom of your chassis; below the bot's center of gravity where it should be!

Tip: Clean the tires with isopropyl alcohol wipes before each match for optimal traction.

Motor

https://www.pololu.com/product/1585

Pololu Metal Gearmotors » 25D mm Metal Gearmotors » 6V Low-Power (LP) 25D mm Gearmotors »
47:1 Metal Gearmotor 25Dx52L mm LP 6V

Pololu item #: 1585 **29** in stock
Brand: Pololu
Status: Active and Preferred
Free shipping in USA

Price break	Unit price (US$)
1	19.95
10	17.96

Quantity: 1 Add to cart
backorders allowed Add to wish list

This gearmotor consists of a **low-power, 6 V** brushed DC motor combined with a **46.85:1** metal spur gearbox. The gearmotor is cylindrical, with a diameter just under 25 mm, and the D-shaped output shaft is 4 mm in diameter and extends 12.5 mm from the face plate of the gearbox.

Key specs at 6 V: 120 RPM and 250 mA (max) free-run, 65 oz-in (4.7 kg-cm) and 2.4 A stall.

Dimensions

Size:	25D x 52L mm
Weight:	88 g
Shaft diameter:	4 mm

General specifications

Gear ratio:	46.85:1
No-load speed @ 6V:	120 rpm
No-load current @ 6V:	250 mA[1]
Stall current @ 6V:	2400 mA
Stall torque @ 6V:	65 oz·in
Motor type:	2.4A stall @ 6V (LP 6V)
Encoders?:	N

APPENDIX III - TAKE A TAPE APART

Take a tape apart

This manual is meant to guide you through the process of taking a unit apart in order to change a broken measuring tape. However, you may refer to it in order to change any other part of the unit as the steps will be the same: simply follow them until you reach the faulty part, replace it and follow the steps backwards until the unit is put back together.

Although this artwork looks challenging to repair, taking the tapes apart is difficult but not very complex. It does require a lot of patience and a delicate hand. Some pieces of the units are very fragile: please proceed methodically and with care.

For a photo and description of the unit's components, please refer to the "Hardware" on page 21.

IMPORTANT:

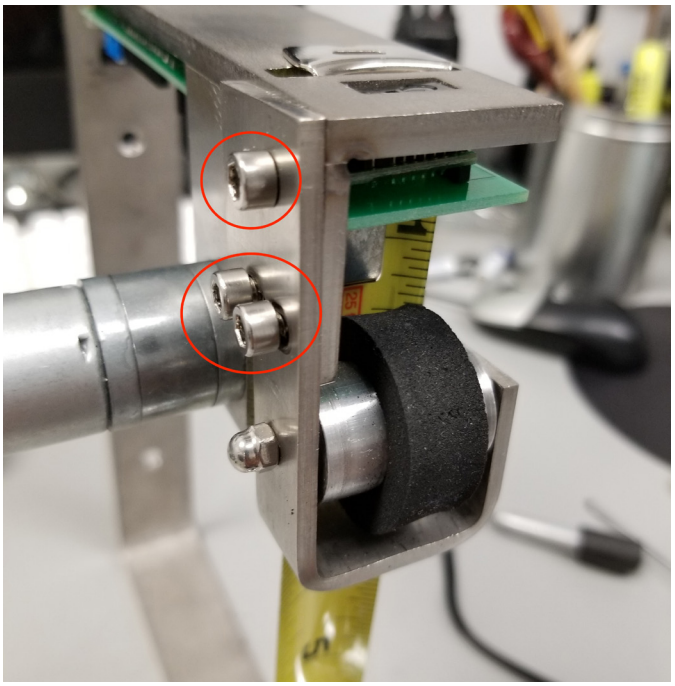
-Keep all the screws and small parts together in a bowl or a plate to avoid losing anything.

-Work on a flat, sturdy surface and be careful when manipulating the unit: it may easily fall on its side, which could potentially severe the wire connections on the motor.

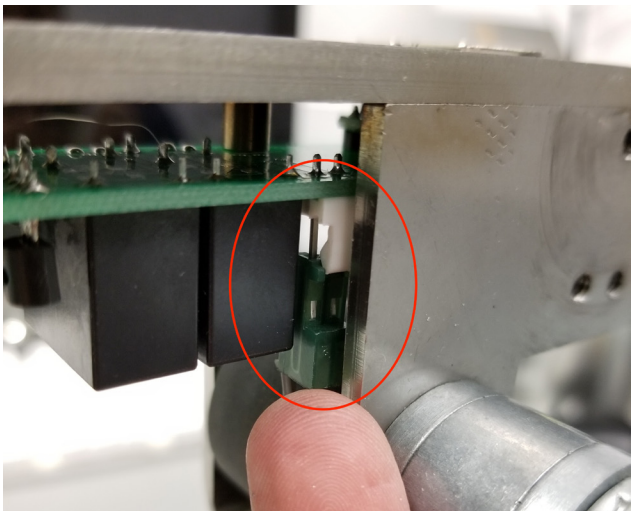
You will need the following tools to work. They are all provided with the piece.

- 2 Hex keys, different sizes
- 2 custom tool for motor screws
- 1 small flat screwdriver
- 1 custom set-screw tool

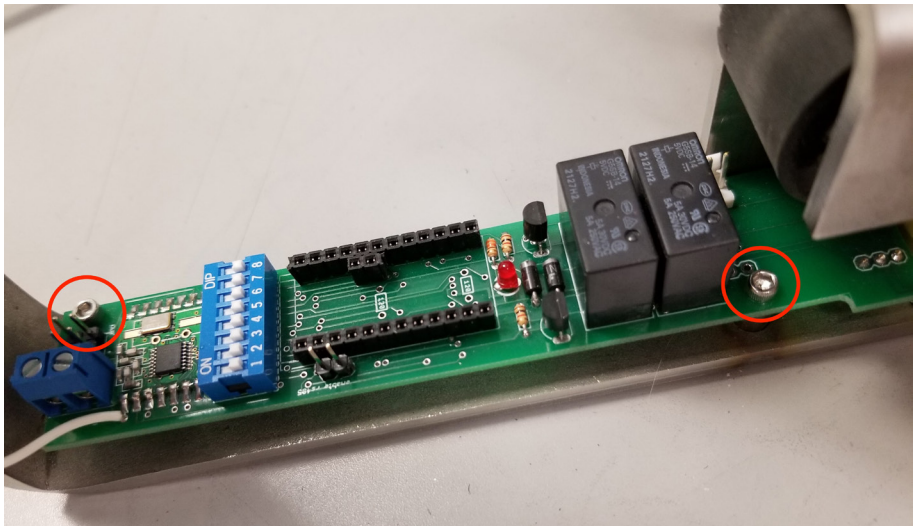
1. The first step is to remove the foam wheel holder. With bigger Allan key, unscrew the 3 screws on the side as shown below:



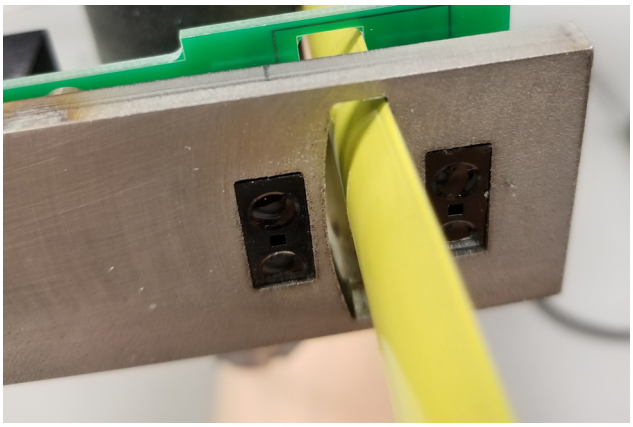
2. Unplug the cable that goes from the motor to the logic board. Be careful not to pull the wires out of the green connector. Using a small, flat screwdriver to push the green connector down makes it easier.

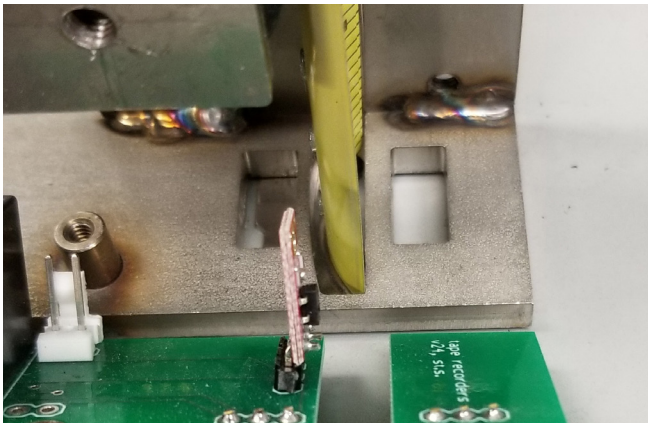


3. Using the smaller Allan key, unscrew the 2 small screws located at opposite corners of the logic board as shown below:

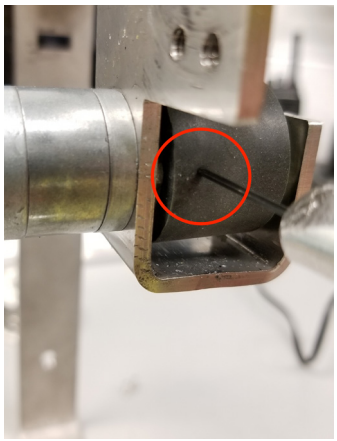


4. Gently push the sensor out of the holes to release the board. Be careful not to bend the red sensor on the other side!





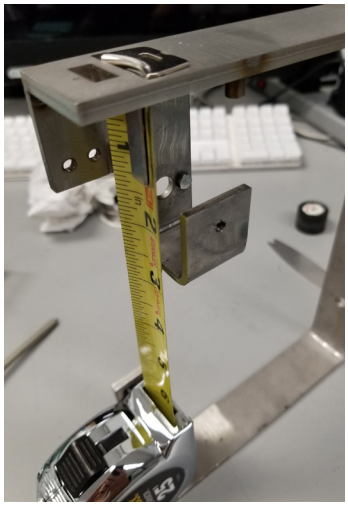
5. Using the tool shown on the photo (the one provided with the piece might have a different handle), find the setscrew on the rubber wheel. The setscrew keeps the wheel tightly attached to the motor shaft and has to be loosened before the motor can be removed.



6. To remove the motor, unscrew the 2 small screws attaching the motor to the structure. Using the tool shown below, proceed to unscrewing both screws.

7. Remove the wheel and put aside with all the screws.

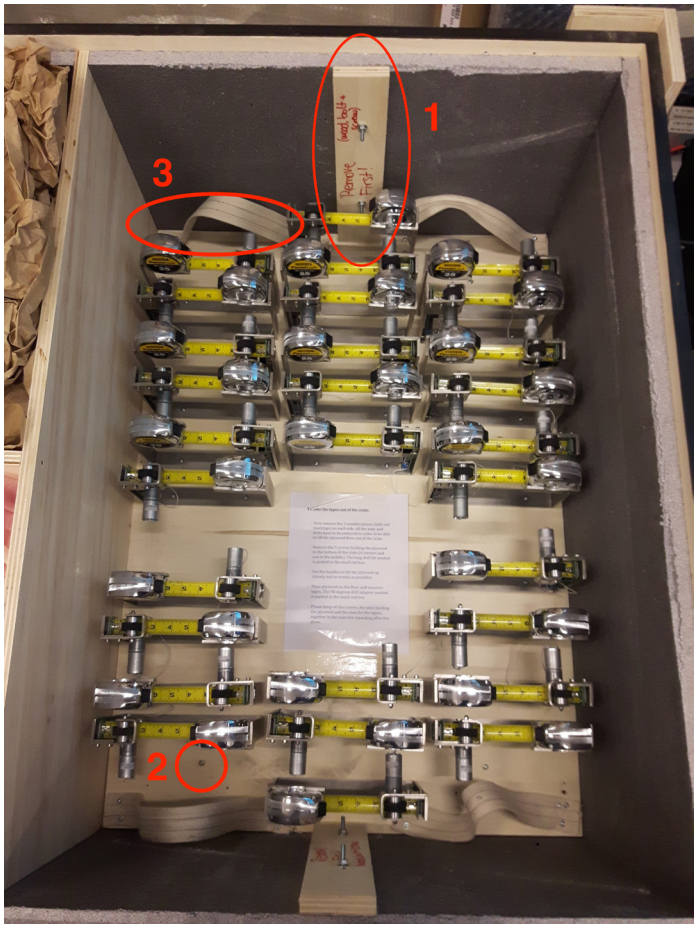
8. To change the tape, you need to bend it around in the structure in order to be able to take it out. See pictures below to help you out. Be careful not to bend the tape more than needed as it may snap and rip.



9. Finally, unscrew the tape from the metal frame by unscrewing the 2 screws holding it in place as shown here.

Crating / uncrating the piece

This section is meant to guide you through taking the piece out of the crate.



1. First remove the 2 wooden pieces (with red markings) on each side. All the nuts and bolts have to be removed in order to be able to lift the plywood floor out of the crate.

2. Remove the 5 screws holding the plywood to the bottom of the crate (4 corners and one in the middle). The long drill bit needed is packed with the piece.

3. Use the handles to lift the plywood up (slowly and as evenly as possible).

4. Place plywood on the floor and unscrew tapes. The 90 degrees drill adapter needed is packed with the piece.

5. Please keep all the screws, the ones holding the plywood and the ones for the tapes, together in the crate for repacking after the show.