Motors & Movement

Electric Sky Workshop
Andrew Cole 2025

What We'll Cover

- Moving things generally
- Types of motors
- Attaching things to motors
- Controlling motors

Who are you?

Andrew Cole

Seattle-based artist and engineer

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What do you want to build?

You might not want a motor

Lever

Crank

Spring

Wind

Eyes Up Here

AC Motors

Alternating Current

Wall plug. High voltage.

- Most appliances
- Box fan
- Clothes dryer
- Treadmill
- Table saw

DC Motors

Direct Current

Anything that runs on batteries
or electronics with a power supply brick

“Regular” DC motor

Servo

Stepper

“Regular” DC motors

Brushed

The most basic.
If something is just called “DC motor”
and doesn’t say “brushless” then it is this kind.

2 wires/lugs

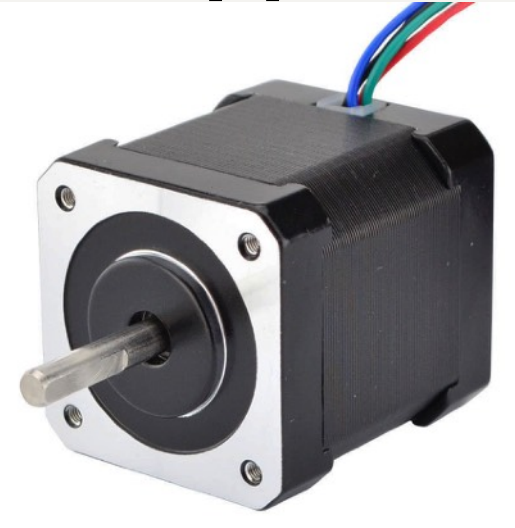
Brushless

At least 3 wires/lugs

Regular DC Motors

Great when you just want something to turn but you don’t care about precise rotational position or speed of the motor

Steppers



A motor with each motor winding exposed on its own wire. Designed for precision movement and repeatability.

Needs special controller.

Moves precisely but doesn’t have a position sensor (provide your own)

Used in 3D printers, CNC machines, scientific equipment, precision robots

Microscope Table

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Servos

AKA “Hobby servo”

A motor with position sensor and controller built in. Need to send it servo signals, not just voltage. Always have a 3-wire connector.

Goes to a position and holds it.
Normally about 200° range of rotation.

Used in robotics and radio controlled toys.
Industrial servos used in e.g. sewing machines

The Simpsons Colonoscopy Party

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RC Motor Ecosystem

Servos

Brushed/brushless motors

ESC (Electronic Speed Controller)

RC Transmitter

RC Receiver

Not too much money

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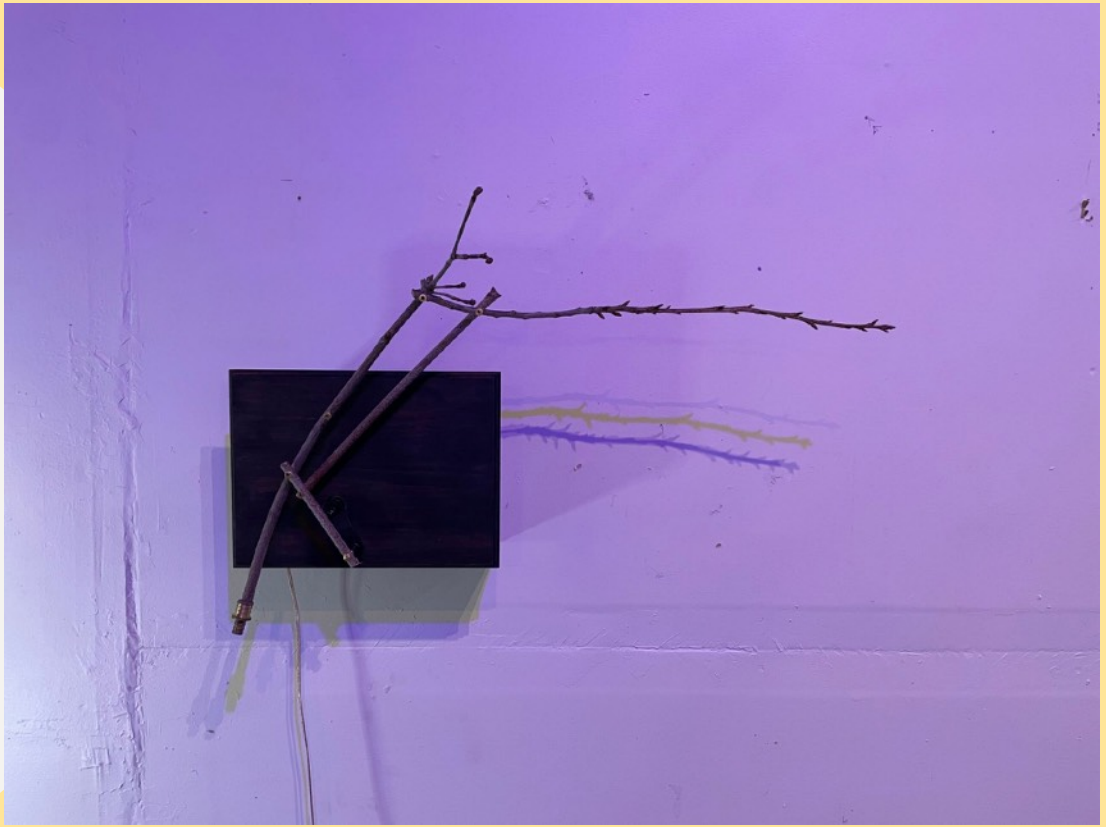
Improbo Coeptis

Windshield Wiper Motors

12V DC, high torque, no backdrive, home position sensor

Promise

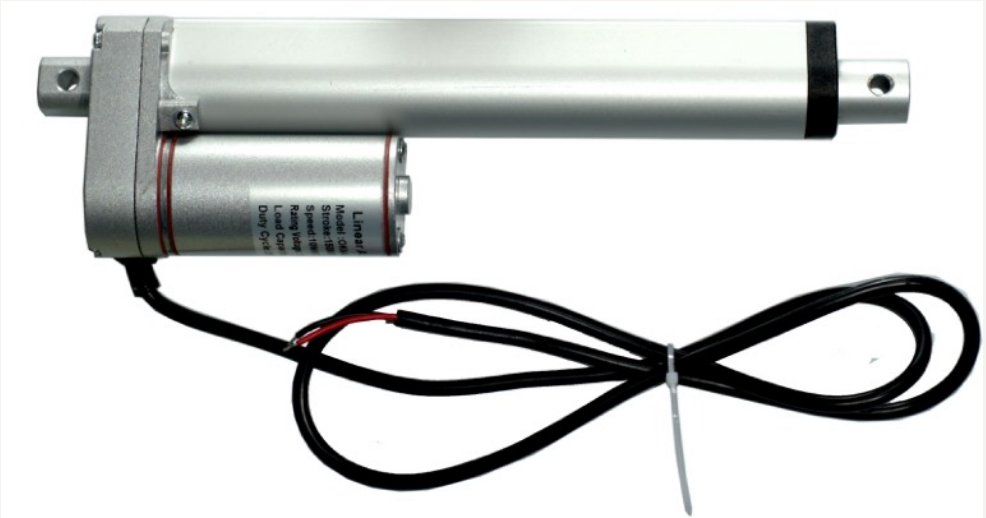


Haunted House
Air Puffer Effect

Dye Bath Agitator

Linear Actuator

Move in a straight line. Slow, kinda fragile



Microscope Table

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Gear Motors

A motor with a gearbox on it.

You probably want this.

Servos, linear actuators, and windshield wiper motors are all examples of gear motors.

A plain motor stalls easily. This also causes its power consumption to go up a lot and it can overheat and burn out.

Attaching to stuff

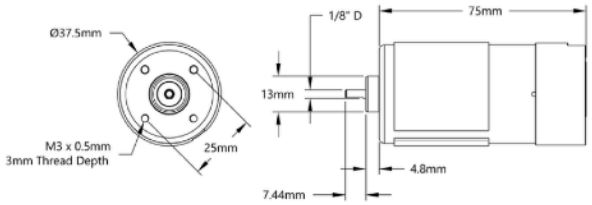
Motor Mounting

Holding the motor case

Motor shaft attachment

Attaching to the moving part of the motor

Faceplate Mounting



Faceplate Mounting

Faceplate Mounting Brackets

Non-faceplate mounts

The size of motor probably has
a name - try to figure it out and see
if there is a mount for it easily available.

Search “130 motor mount”

Otherwise clamp it down.

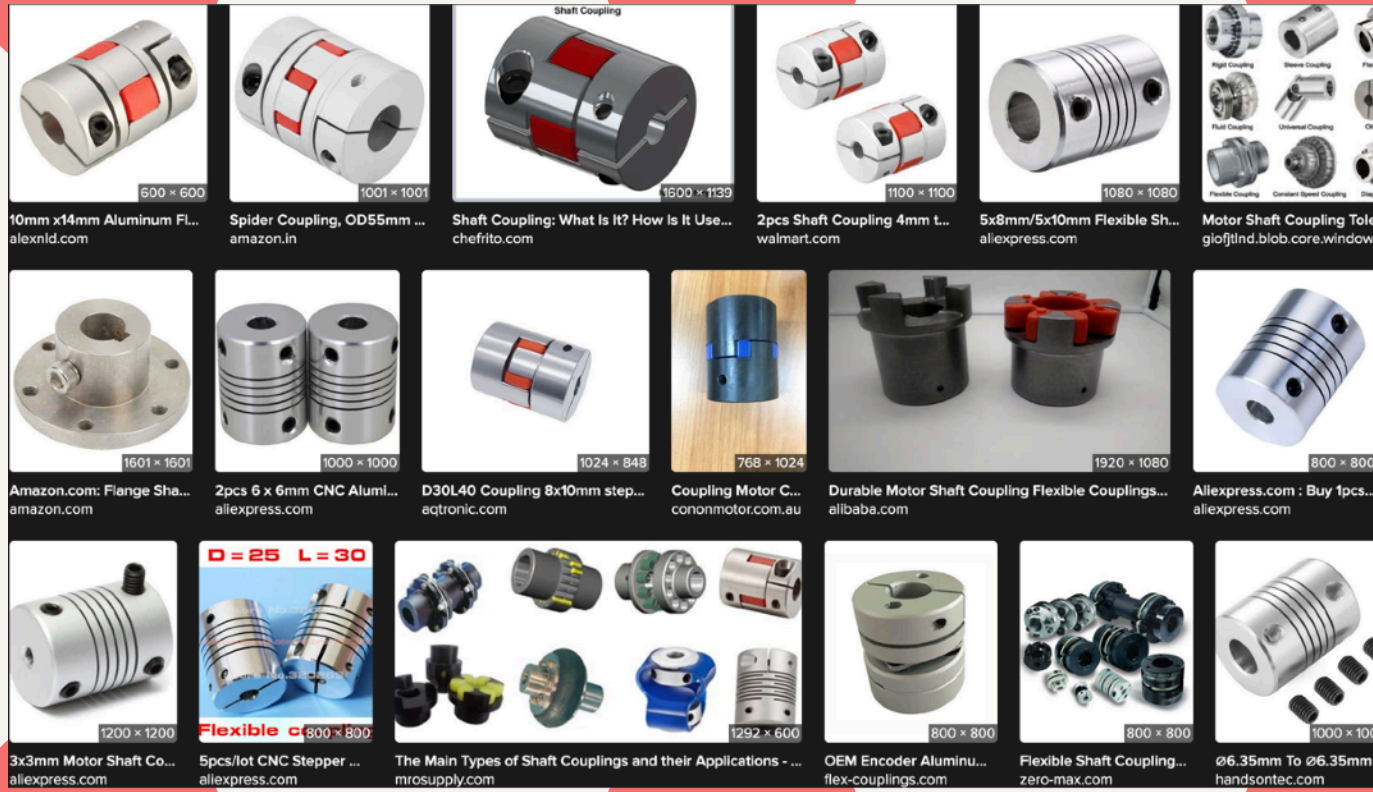
Don’t use tape, glue, or zip ties…
or don’t be surprised when they fail

Common toy &
small electronics motor
called “130”

Motor Shaft Attachments

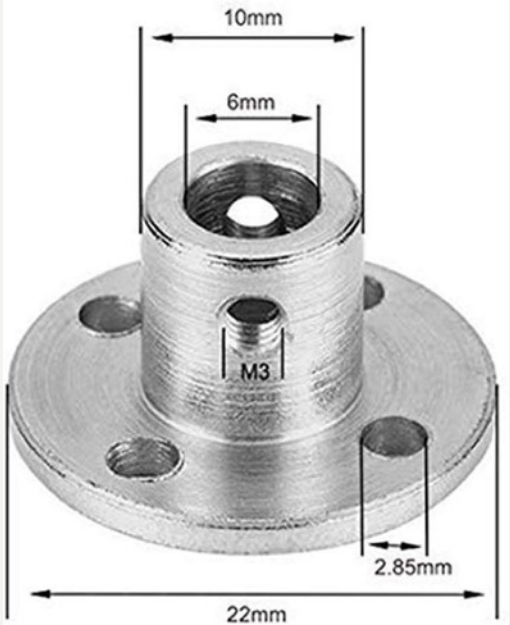
Couplers

Shaft-to-shaft attachments
Sold by bore size(s)



Motor Shaft Attachments

Flanges, sprockets, pulleys



Controlling motors

PWM

Pulse width modulation - good for speed control of regular brushed motors

H-bridge

Change the direction of a motor

Brushless motor controllers

It's complicated. Buy things that say they are compatible. Stick with RC stuff and you'll be fine.

RC ESC

Electronic speed controller. Lots of cheap options from the RC world

Servo controllers

Servos require special pulse timing to operate. Buy a board that can do this or use e.g. Arduino library code

Switching

Motors can draw a lot of current which can cause switches to arc or weld. Use switches/relays/contactors made for this if it's an issue.

Stuff I don’t have time to cover but will maybe be important

Bearings

Not working because of too much friction? Use bearings. Skateboard bearings are good and cheap. Easy to use.

Linkages

Convert rotary motion to linear motion or many other shapes. 4-bar linkage is your friend.

Slip rings

When you need wires to go through a rotating joint without getting twisted.

Power supplies and batteries

Motors use a lot of current, and a lot of power total. Don’t run a motor off the logic pins on a microcontroller

Resources

- **Making Things Move** - Great book covering more than just motors
- **Tim Hunkin's Secret Life of Components videos** - Incredible resource for all kinds of artistic machine-making
- **Jeremy Fielding's videos** - More in-depth motor basics
- **MotionGen linkage simulator** - design linkages
- **Adafruit** Robotics section - Thoroughly-documented project guides & motor control products for sale
- **ServoCity** - Expensive but high-quality, high-torque motors & motion components that are all compatible with each other like Legos.
- **RoyMech Drive Components** - Definitions/descriptions of different parts used in drive mechanisms. Lots of other useful stuff on this site.

Questions?

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