

Motors and Servos

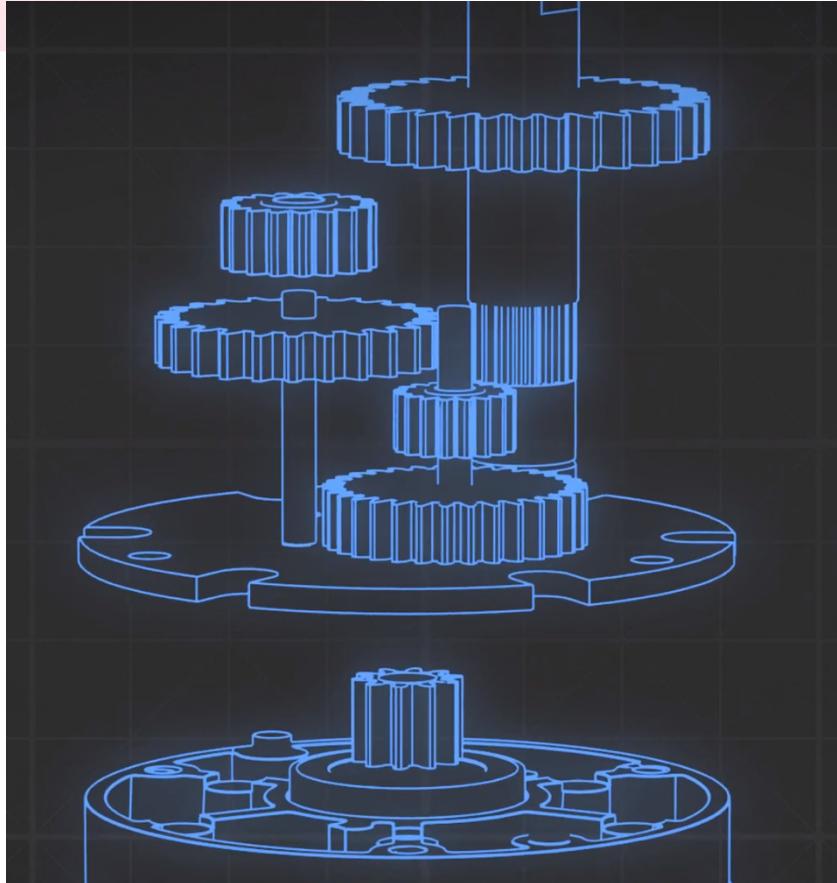
The Antidote - FTC 14320



Motors

- In the FIRST Tech Challenge, teams are only allowed to use up to **eight motors**
 - Four on each REV Expansion Hub or Control Hub
- Every motor has a set max torque and max speed.
 - **Gearbox ratios** help manipulate the max torque and max speed to best suit certain applications
 - A general rule of thumb is be **under half** of the motor's stall torque (can usually be found in motor specifications)

Types of Motors



- **Spur Gear Motors**
- Consists of numerous reduction (\uparrow torque, \downarrow speed) geared stages
- Output shaft is typically **not centered** with the gearbox
 - Helps with belt/chain tension
- **Less durable** than other gearbox options



Types of Motors



- **Planetary Gear Motors**
- Consists of numerous sun + planet reduction stages → **extremely reliable/efficient**
- **Centered** shaft and compact → better radial/axial load

Types of Motors



- **Through Bore Motors**
- Instead of having an **output shaft**, through bore motors have a slot so that a shaft can be inserted
- **REV Core Hex Motor**
 - Spur Styled Gearbox
 - Any shaft length can be used
 - Very loud & inefficient power output
 - Unusual gear ratio
 - 72:1 is not commonly used
 - Uses a **less** powerful motor than other FTC motors

Types of Motors



- **Bare Motor**
- These motors (sold by AndyMark and REV Robotics) do **not have an external gearbox**, only a pinion gear
- Teams use bare motors for custom gearboxes, primarily for **lift mechanisms** or intakes

Motor Comparison Chart



Type	REV HD Hex	AM Classic	Tetrix TorqueNADO
Gearbox	Spur	Spur	Spur
Ratio	20:1 / 40:1	40:1 / 60:1	20:1 / 40:1 / 60:1
Cost	\$28	\$29.50	\$30

Motor Comparison Chart



FIRST
TECH
CHALLE
LEGAL

Type	AndyMark Orbital	REV UltraPlanetary	REV HD Hex	goBILDA Yellow Jacket
Gearbox	Planetary	Planetary	Planetary	Planetary
Ratio	3.7:1 / 19.2:1	3:1, 4:1, 5:1 Cartridges	19.2:1	3.7:1 to 188:1
Cost	\$33	\$36	\$32	\$30 (with discount)

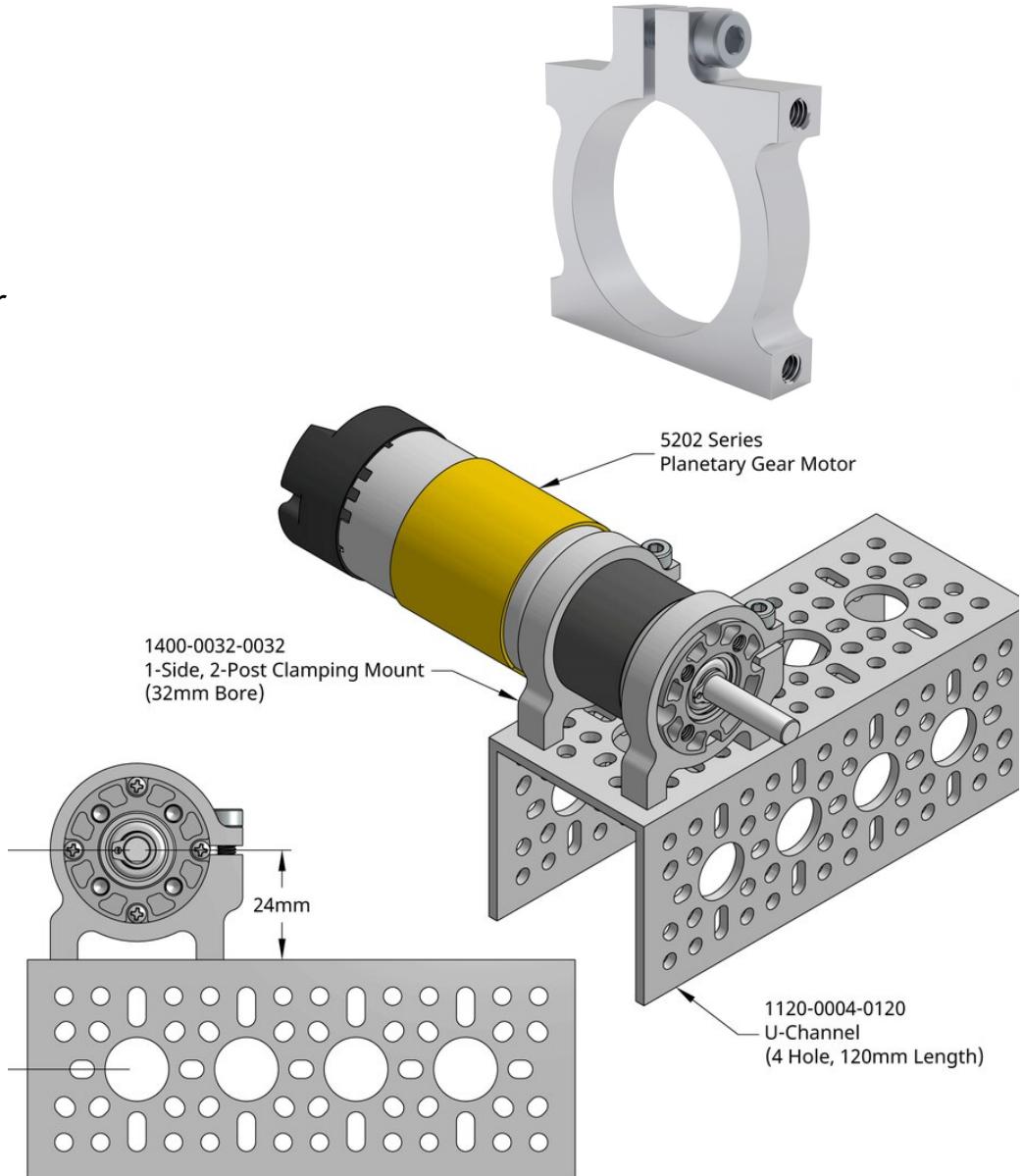
Selecting a Motor

- **Avoid** using spur gear motors (not recommended)
 - Spur gears are made of numerous layers of gears to create the final ratio
 - Spur gears wear down **rapidly** → leads to a free moving shaft
 - Can not withstand the rigors of the FTC competition
- **Use planetaries! (recommended)**
 - Planetaries are the **most reliable** motors to use in FTC
 - Load is distributed equally among the gears
 - Very **rare** for a planetary motor to break down
 - goBILDA offers a **wide range** of ratios to be used in **any** FTC application.

Motor Mounts

- **Clamping Mounts**

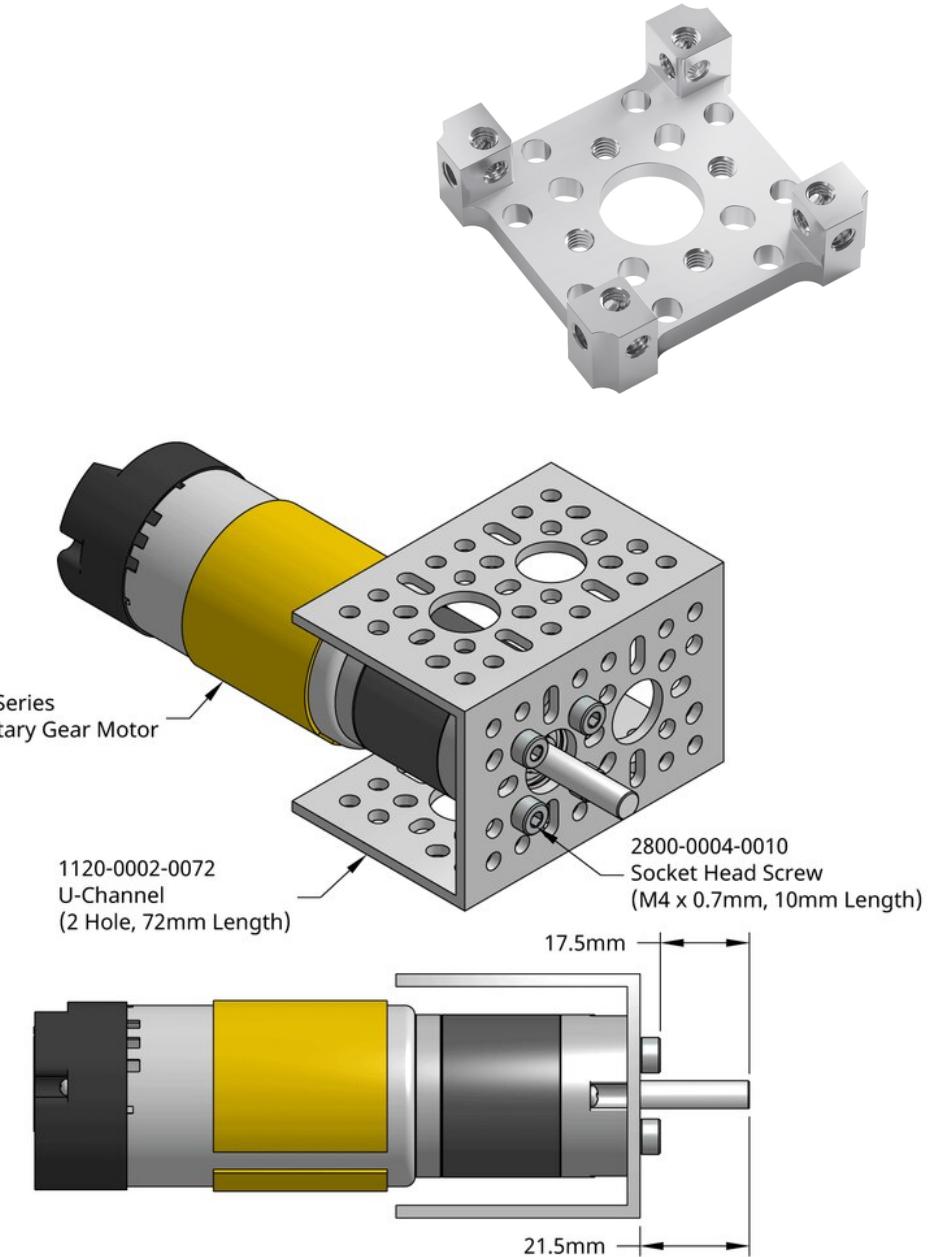
- **Clamps** onto the circular body of the motor
- Tapped holes allow the motor to be placed on **any flat surface**
- Different motor brands have different motor diameters



Motor Mounts

- **Face Mounting**

- Uses the **screw holes** on the face of the motor to mount the motor
- Can either use a physical bracket to help with the mounting process
- **Recommended** option for FTC applications compared to clamping mounts



Servos

- In the FIRST Tech Challenge, teams are only allowed to use up to **twelve servos**
 - Six on each REV Expansion Hub or Control Hub
- Every motor has a set max torque and max speed.
 - **Gearbox ratios** help manipulate the max torque and max speed to best suit certain applications
 - A general rule of thumb is be **under half** of the motor's stall torque (can usually be found in motor specifications)

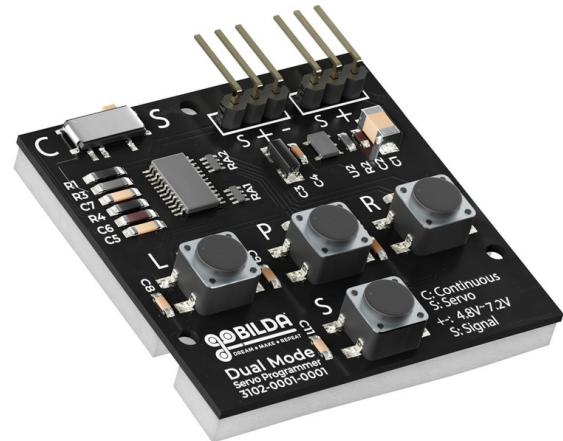
Types of Servos

- **Positional (standard) Servos**
 - Servos are primarily used for **precise** and **repeatable** moves
 - Can only rotate around 180 to 270 degrees
 - The input signal manipulates the position of the servo spline
- **Continuous Rotation Servos**
 - These servos are similar to motors
 - The input signal manipulates the speed and direction of rotation
 - Continuous Rotation servos typically do **not** have any form of positional feedback



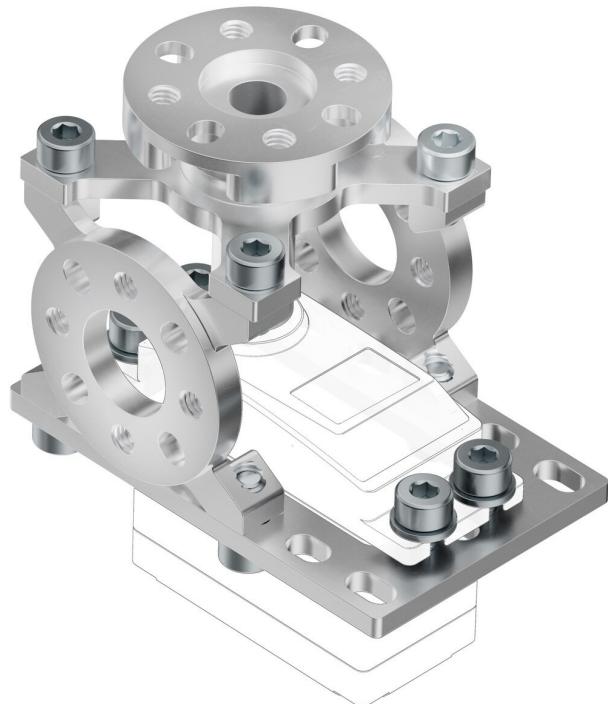
Programming Servos

- A Servo Programmer (like the ones in the images) can set **custom end-stops** for positional servos and **change the mode** of certain servos from Continuous Rotation to Positional and vice versa.
 - The programmer can change the mode of REV's Smart Robot Servo and goBILDA's Dual Mode Servo.



Servo Blocks

- Sold by ServoCity and goBILDA
- A limiting factor of servos is the amount of **radial load** that the servo can handle.
- ServoBlocks acts as an **exoskeleton** and **isolates the load** onto the bearing located above the servo spline.
- It is recommended that teams use ServoBlocks for any intensive or high-torque application



Servo Power Module (SPM)

- Sold by REV
- When a robot has **many** servos pulling current, the Servo Power Module ensures that servos will receive 6 Volts and 90 Watts of power.
 - This ensures that the servos connected to the SPM will run with **consistent** and maximum power.



Credits

- This lesson was written by The Antidote 14320 for FTCTutorials.com
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