NXS Robotics Reverse Engineering Challenge Submission

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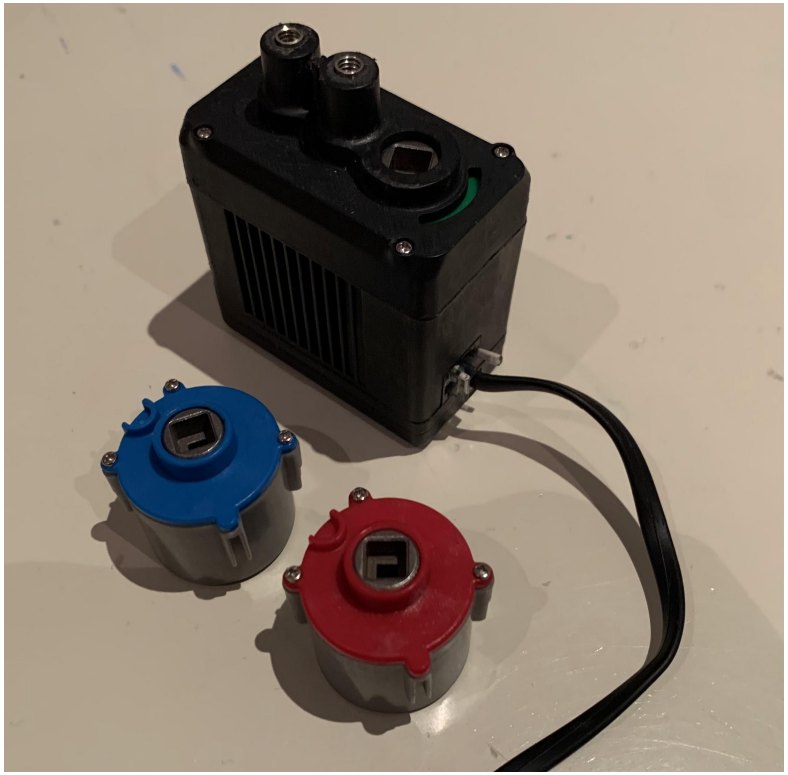
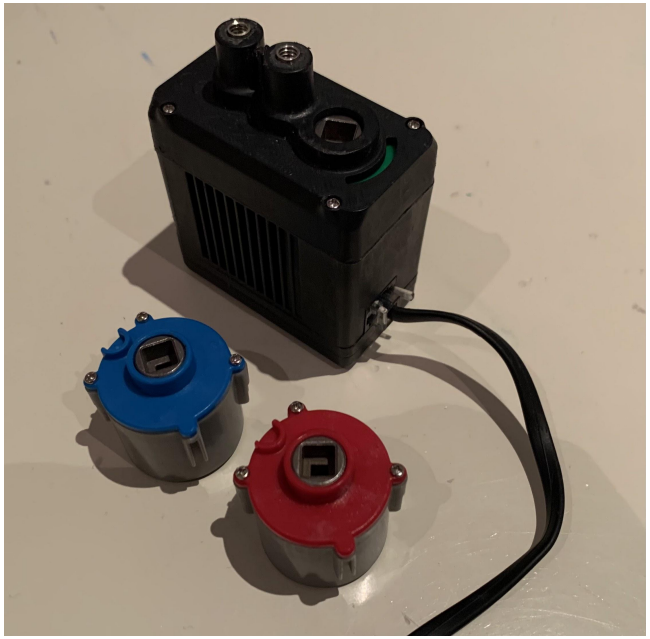
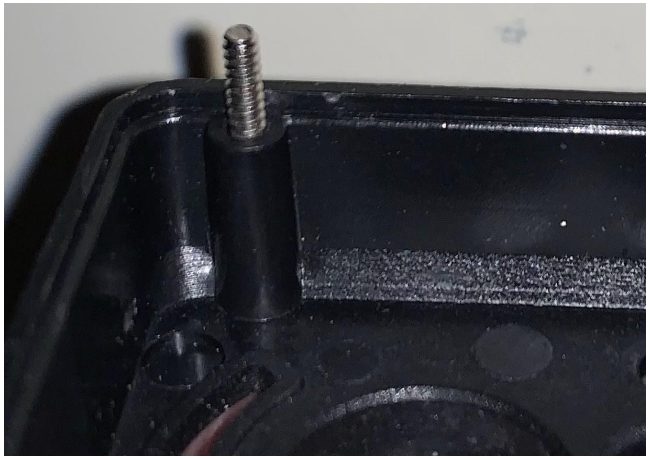
Based in Ontario, Canada

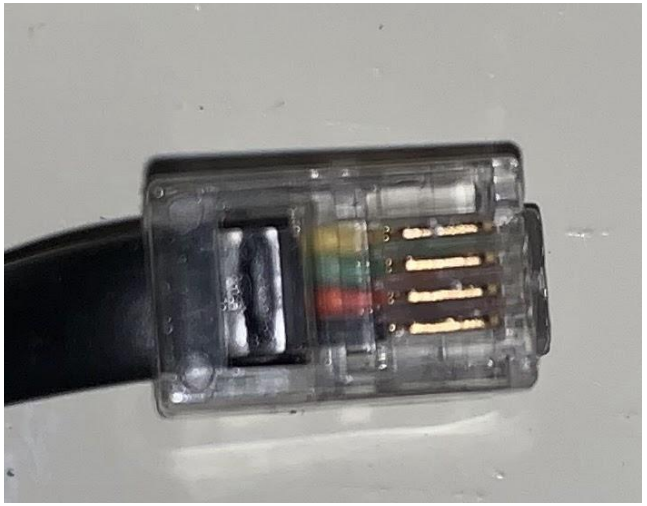
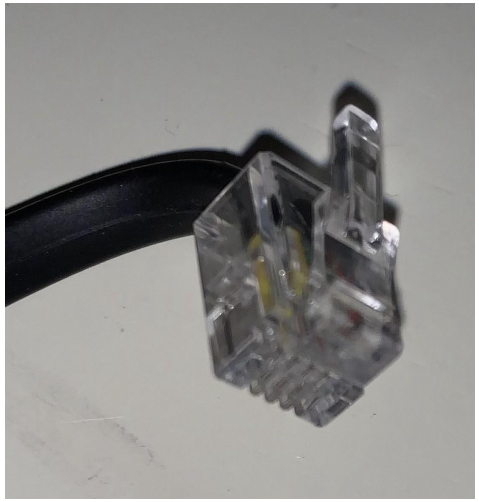


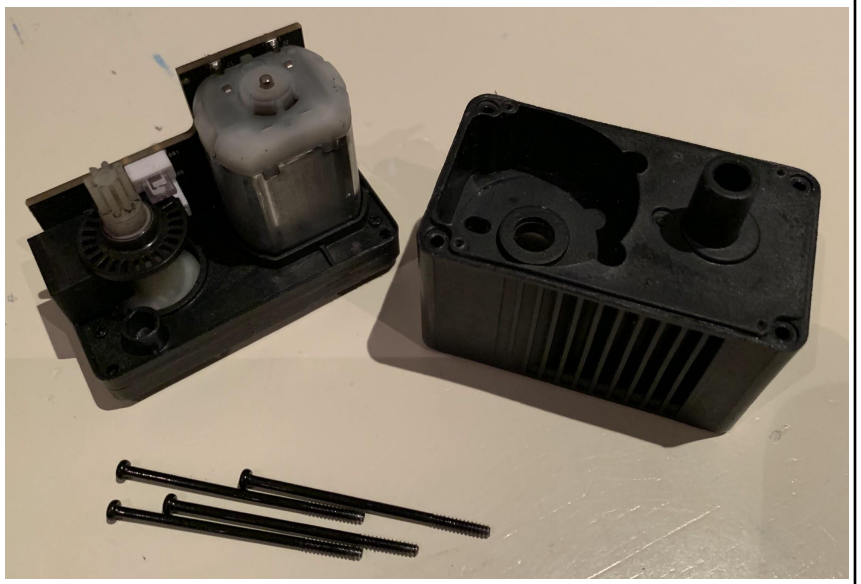
A Documented Dissasembly of the Vex V5 Smart Motor

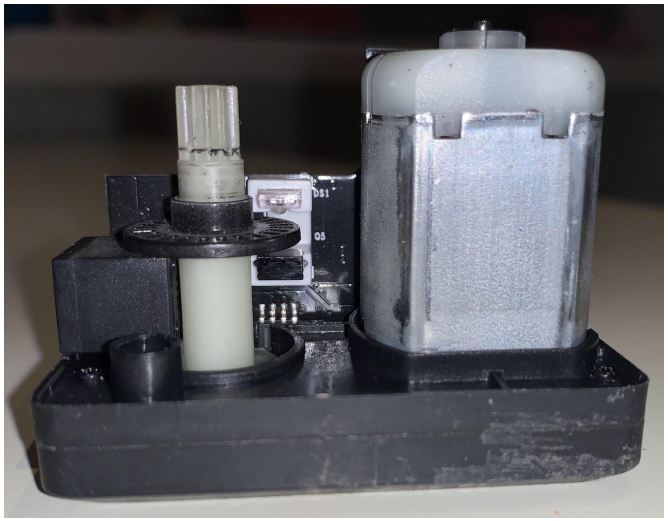
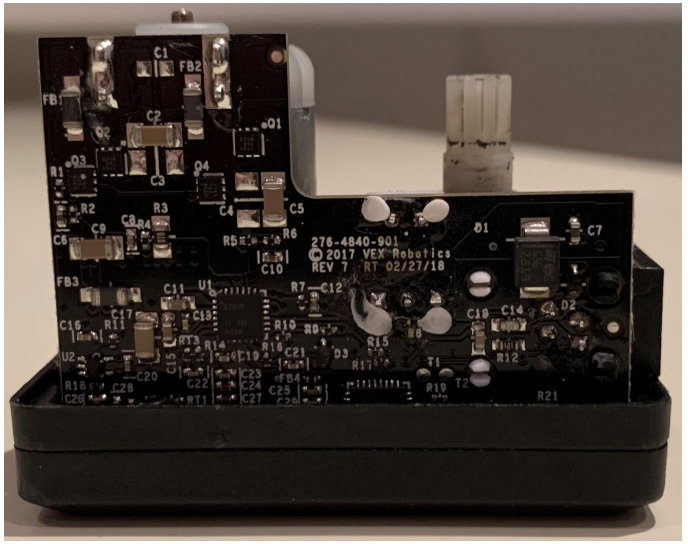
		
The V5 Motor, along with its primary peripherals: the wire and 3 planetary gear output cartridges.	A closer look at the motor and wire on its side.	The motor with the wire removed. Its predecessors did not have this ability.

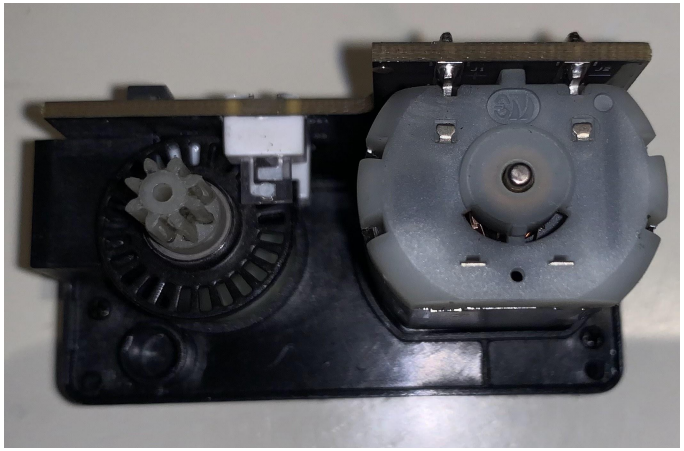
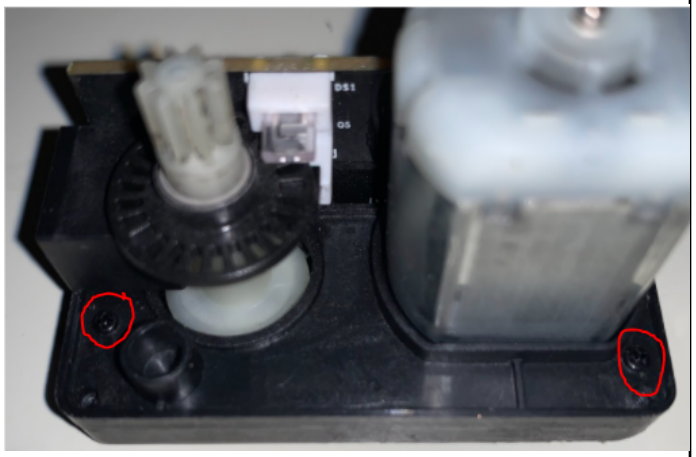
		
Next, the bottom cap is removed. This is the most common operation in normal use, necessary to switch between cartridges.	A closer look at the bottom cap and its internal standoffs. These feature protruding cylinders that align the motor in the square holes of Vex metal.	With the cartridge removed, the plastic eight-tooth output gear at this stage of the motor is visible.

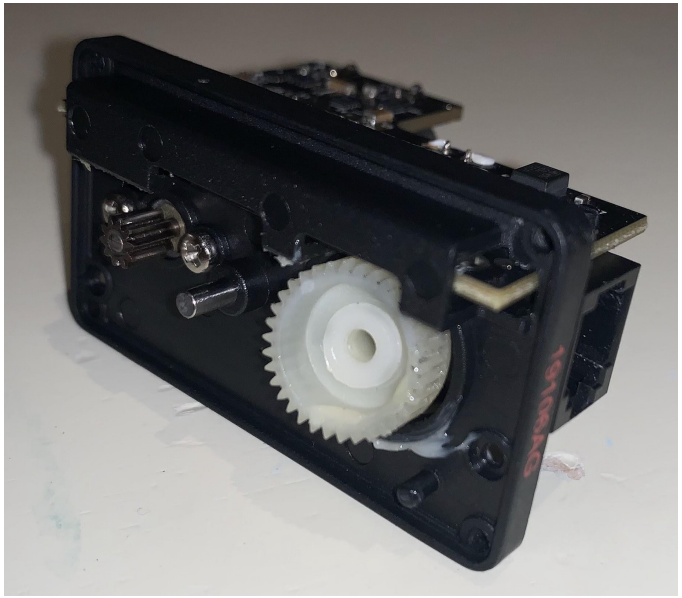
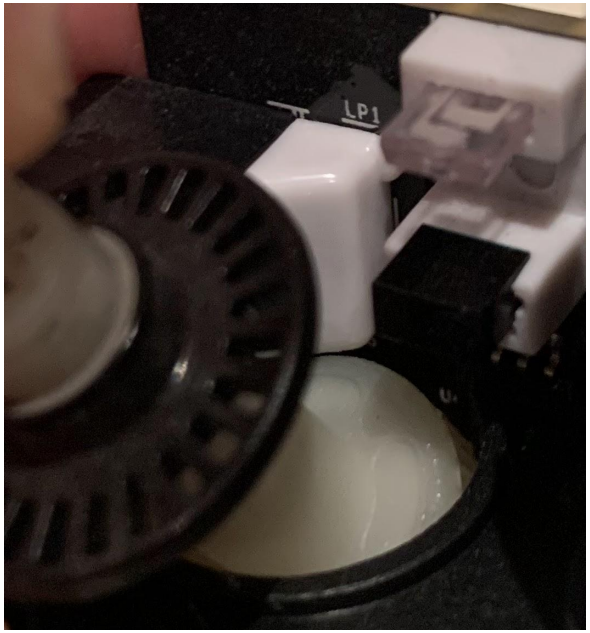
		
A noteworthy quirk of this motor's design is that only a small portion of these silver screws thread into anything, however, the whole screw is threaded.	The inside of the bottom cap. The hexagonal holes that the internal standoffs sit in are visible, as well as the slit that allows external viewing of the cartridge colour.	A closer look at the bottom cap screws.

		
The motor’s wire port and its serial number are visible from this angle.	The wire consists of four smaller wires. Yellow through black are ‘A’, ‘B’, negative, and positive respectively. This can be reversed depending on how the wire is made. ‘A’ and ‘B’ are used for communication.	Another perspective of the wire, showing the tab that helps hold it in place.

		
With the top cap removed, the main body can be isolated. This is the side that encloses the internal motor.	At this stage, these are the parts that become separate: the main body, more screws, and the inner motor and connected components.	In contrast to the previous screws, these are only threaded where they are needed.

		
On the right is the motor. On the left, the output gear from a hidden gear train. This gear has a disc with many slits, which is part of an encoder.	The encoder works via the white LED and black photoresistor, counting the flashes as the disk spins.	The back of the circuit board is rather detailed, but also reveals basic information like when it was made (2017).

		
Another perspective of this stage of the motor.	From this angle, the two small screws needed to remove the final cap are visible.	The previously mentioned gear train, connecting the internal motor's output (metal gear) to the plastic output gear that interfaces with the cartridges.

	 	
The top cap of the motor. This contains one of the two axles that the gears in this stage rotate on.	The second axle is mounted to this piece, as well as the circuit board, motor, and wire port. To increase performance, this section is pre-lubricated. Above are the two screws that held the top cap on.	Now, this gear can be angled, giving a clearer view of the encoder LED/sensor pair. This design is typical of an optical encoder, and is a scaled-down version of those that can be bought separately and plugged into the brain’s 3-wire ports. .